TRANSACTIONS

OF THE

MEDICAL AND PHYSICAL SOCIETY

OF

BOMBAY.

No. VI. NEW SERIES.

FOR THE YEAR 1860.

Bombay:
PRINTED AT THE
EDUCATION SOCIETY'S PRESS, BYCULLA.

1861.

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The Secretary of the Medical and Physical Society, as Editor of its Transactions, greatly regrets that several unforeseen circumstances have prevented the publication of the present Volume until this late date, but he trusts the delay will not again occur.

It is anticipated that the next Volume will appear punctually on 1st January 1862.

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APPENDIX.

TOPOGRAPHICAL AND GEOLOGICAL SKETCH OF THE PROVINCE OF SARAWAN, OR NORTHERN PORTION OF THE TABLE-LAND OF BELOOCHISTAN.

[With a Plan and Section.]

BY ASSISTANT SURGEON H. COOK, M.D.,

In Medical Charge, Kelat Agency.

Presented March 1860.

The territories of the Khan of Kelat, comprised under the term "Beloochistan," are extensive and varied in character to no ordinary degree. They consist of lofty, rugged table-land and level ground, and their climates exhibit the severest heat and the most intense cold.

Viewing them geographically, they fall into the natural division of mountain and plain, and may be considered under the following heads:—

1*st.*—The great Central Mountain Range or Table-land running north and south, which comprises the provinces of Sarawan, Jhalawan, and Lus.

2*nd.*—The Mountain District extending eastward, inhabited by the Murrees and Boogtees, situated to the north of Sind and Kutchee.

3*rd.*—The province of the Plains, that is, the district of Kutch Gundava.

4*th.*—The province of Mekran, diversified by mountain and desert, which stretches westward along the sea-coast.

5*th.*—The great Desert of Seistan to the north of the last-named district.

It is the first of these great divisions that I am now about to describe, or, rather, the portion of this comprised under the name of the province of Sarawan.

The mountainous table-land of Beloochistan extends from Cape Monze, on the south, to the Affghan mountains north of Quetta;

or, from 25° to 30° 40′ N. Lat., and is, consequently, about 340 miles in length.

In breadth it extends from the level plains of Kutchee eastward, to Nooshky on the borders of the Seistan desert westward, extending thus about 150 miles. But its breadth is by no means uniform: widest about the centre, it gradually narrows southward, until, at Cape Monze, the range is only a few miles in diameter.

The height also varies in the same proportion: the greatest altitude is attained at Kelat (about 7,000 feet), where the climate is European; southward it rapidly decreases, until, in the province of Lus, the elevation is but a trifling degree greater than that of Sind. It decreases also northward, the height of Quetta being about 5,900 feet.

Ranges.

This elevated district is composed of a succession of mountain ranges, which, rising from the plains of Kutchee and valley of the Indus, tower one above the other in successive steps, until, having gained their maximum, they subside in lesser and lesser ranges westward.

Their general direction is from N.N.E. to S.S.W., and this uniformity of strike is wonderfully preserved throughout.

The mass is broken through at two points, viz. by the Bolan Pass at its northern extremity, and by the Moolla Pass near Gundava. Here the ranges are twisted out of their original direction, and run in a N.N.W. manner.

Through these two great channels the principal drainage of the country is effected, producing the Bolan and Moolla rivers.

Valleys.

Lying in the bosom of the mountains are numerous valleys, as will be shown in the following pages. These have naturally a like direction to the ranges between which they lie, and vary in height according to their position; so that almost any desired temperature and climate may be obtained for the sub-tropical one of Sind to the temperate one of Kelat.

Rivers.

The district is naturally moderately well watered by rivulets and springs, and artificially so by wells and *kurezes*; but there are, as might be inferred, no rivers of any magnitude.

The transit through the country is effected on foot, horseback, or on camels; and there are no roads, properly so called, nor bridges; nor is any wheeled conveyance ever used by either class of the inhabitants. Camel tracks intersect the valleys, and footpaths cross the hills, or lead through ravines so deep and devious as almost to be excluded from the sun's direct rays. This is especially the case when an easterly or westerly direction is taken; but in proceeding north or south through the country, no obstruction is met with which could prevent the passage of artillery.

Roads.

The highest ranges are clothed with trees (junipers), which yield excellent firewood and durable timber for building.

Wood.

They are inhabited by foxes, jackals, hyenas, wolves, and panthers. In the cold season the wolves become so bold and ravenous that they descend into the valleys and attack the flocks, killing considerable numbers of goats and sheep.

During the latter part of our stay at Kelat they repeatedly entered the camp at night and killed the sheep within a few yards of the tents.

The province of Sarawan extends from Quetta to Kelat; through it is the great high road leading from Affghanistan to India, either eastward, by way of the Bolan Pass, or southward, passing through Kelat. Having fortunately had the opportunity of seeing the district throughout, I shall briefly describe it in the order of our line of march, commencing at its northern point.

Valley of Quetta, or Shawl.

The valley of Quetta is situated in 67° E. Long., and 30° to 30° 20′ N. Lat.

It is about 15 or 20 miles in length, and from 4 to 6 in breadth. It is bounded to the westward by the Cheheltan range, having a strike of S.S.W. by N.N.E.; on the east by parallel ranges which form a part of the mountain-chain through which runs the Bolan Pass; to the northward by the Tukatoo range, a lofty barrier running nearly east and west; to the south it joins the Dasht-i-Bedaulat, but is partially separated from this plain by a lower and smaller range of hills which runs north and south.

The Tukatoo range to the northward presents, in one spot, a curiously shaped summit of two peaks rising close to each other, producing a conspicuous landmark, whilst at the southern end of the westerly range, towers the summit of Cheheltan, the highest mountain in Beloochistan; towards the north this mountain gradually sinks, until, just opposite Quetta, it subsides by a very gradual slope into the level of the valley, which here is connected with the adjoining valley of Kharack. Opposite this point to the eastward opens a pass to the valley of the Hanna; and further south, in the easterly range, is a second pass leading into other valleys of the great mountain range.

Bounded thus on every side by hills of considerable altitude, the valley has a gentle and gradual slope from the Dasht-i-Bedaulat northward.

Its height above the level of the sea, as ascertained by the boiling point of water, is about 5,900 feet.

The soil is rich and good, and the crops luxuriant. The wheat ripens in June, and is reaped about the close of this month —about two months later than it is in Kutchee.

The valley is watered by the Lora, a stream which rises at Sir-i-Ab, about six or seven miles south of Quetta, and flowing northward, and then north-west towards Pishing, probably joins the Helmund river. Other small streams also issue from the hills bounding the valley. These are greatly augmented in size and number after rain, as evinced by the numerous dry water-courses that cut up the valley at the bases of the hills.

Some of these flow with sufficient strength to turn flour-mills. These are constructed on the undershot principle, the water being conducted underneath the wheel by a wooden gutter.

Besides these supplies, there are numerous *kurezes*, which lead from the base of the ranges towards the centre of the valley.

The town of Quetta, or Shawl, is situated at the northern end of the valley, on the direct route from Kandahar to the Bolan. It is a walled town with two gates, east and south. In its centre, on a high mound overlooking the town, is the *miri*, or fort, the residence of the *naib*, or governor. It is built of mud, or unbaked bricks; and from its upper terraces a beautiful and extensive view of the valley is obtained. The

town is estimated to contain about 300 houses, but many of them are now in ruins.

The whole valley appeared just now to be covered with bright yellow wheat-fields, dotted with green lucerne and melon-beds and patches of grass. Several villages are seen in the valley, as Ispingli, Karain, &c., surrounded by orchards and gardens, which produce great quantities of apricots, peaches, plums, apples, quinces, mulberries, and walnuts, with the fig, vine, and pomegranate; but the fruit is not so fine as that of Moostung, and inferior in flavour. Bordering the streams are many English grasses and field plants, as, the thistle, dandelion, greater and lesser plantain, trefoil, clover, &c. &c. In a gorge in the hills I found a wild fig growing from a cleft in the rock, and in the ravines are numerous labiate plants, as wild lavender, mint, and sage. A fine short grass grows by the streams, and the waste, uncultivated tracts are covered by a plant called *terk*, or *bunti*, by the natives, having a strong aromatic odour.

The atmosphere during the time we were at Shawl—a portion of the month of June—was pure and clear. The heat in the day moderate, and by no means oppressive. The nights cool and pleasant. The mean temperature between sunrise and sunset in my tent was as follows:—

	Dry Bulb.	Wet Bulb.
Day	79°4	59°
Night	59°2	49°

Geology.

The mountain range, as before said, has a general N.N.E. by S.S.W. strike, and the strata dip to the west above an angle of from 45° to 60°.

They belong, I believe, to the nummulitic limestone series, although I nowhere saw any nummulites *in situ*; yet towards the opening of the Hanna valley, pebbles and boulders of nummulitic limestone were scattered thickly over the ground.

Through the range to the east ran a gorge at right angles, which presented a good section. I found, first, a hill about 400 or 500 feet high, with strike and dip as above, composed of an exceedingly hard, light-coloured limestone, seamed with thin veins of crystallised carbonate of lime, but containing no fossils;

further on, the scarped sides presented a greater height, the pass narrowing until it allowed the passage of only a single horseman, made up of the same hard, fine-grained limestone; on turning a corner, the second range came in sight, presenting a scarped face to the west, of great height, probably 1,500 to 2,000 feet. The bed of the pass was covered with pebbles and boulders of the same grey limestone, but containing numerous fossils,—casts in crystallised carbonate of lime; the most prominent amongst them were a long spiral shell 4 or 5 inches in length, very long sections of what appeared to be Ostrea, and better preserved specimens of bivalves, Rhynchonella, Cardium, &c. &c.

I examined also the northern end of the Cheheltan range; here also a gorge occurred which presented a section of two hills, and then led into a narrow valley in the bosom of the range.

The first hill was formed of a very hard and compact limestone, of a light-blue colour, seamed with carbonate of lime. Dip E. 45°.

On passing this, the face of a second range was exposed, composed of the same limestone at the base, then 30 or 40 feet of red and white limestone in separate strata, from one to four inches in thickness, alternating with each other, giving a striped appearance to the rock. These strata were capped by grey limestone. From the base of the hill, in a very narrow pass, flowed an exceedingly clear and pure stream of water.

This alternation of thin strata of red and white limestone occurs also in the Bolan Pass, as before stated, near its western termination, and is there also overlaid by a fine, hard, grey limestone, having no fossils.

Valley of Kanhee

Is situated to the west of, and runs parallel to, that of Quetta, but extends further south.

Its length is about 30 miles, and breadth 5 or 6.

It is bounded on the east by the great Cheheltan range, which separates it from the valley of Quetta, and on the west by a parallel range of much less height, which, towards the north, separates it from the valley of Pishing. To the north-west it is

connected with the valley of Quetta, and to the south joins that of Moostung.

Its height is somewhat less than that of Quetta, and it slopes gently to the north. Its soil is of the same character as that of the adjoining valleys, light and rather sandy, but sufficiently plastic when watered. It is, perhaps, more stony, and is certainly less cultivated, although many wheat-fields covered its western side, and the towns and villages were surrounded by trees, gardens, and fields.

It is watered to the north by a small branch of the Lora, and at other points by several smaller streams from the hills, which, in one or two places, are dammed up, forming ponds from which streams for irrigation are taken as required, and *kurezes*. There are also several isolated wells near the villages.

The towns are Kanhee and Teeree, both situated at its southern extremity. They are walled, and contain a few hundred houses, built, as usual, of sunburnt brick. There are also a few villages scattered through the valley, chiefly on its western side. The climate resembles, of course, that of the adjoining valleys, but is somewhat warmer than Quetta. This is due, perhaps, to its being sheltered by the high range of the Cheheltan. The tribes inhabiting the valley are the Raisini, Sheik, Hussein, &c. &c.

Valley of Moostung

Is the principal and most extensive valley of the tract under consideration, and is situated to the south of the valleys of Quetta and Kanhee. It extends from about 29°30′ to near 30° N. Lat., and its eastern boundary is nearly defined by the 67° of E. Long.

It is therefore about 40 miles in length, and varies in breadth from 5 to 8 miles, spreading out towards its upper end, and being gradually constricted towards its lower or southern extremity.

It is bounded by parallel ranges, running N.N.E. by S.S.W., of medium height, probably from 500 to 800 feet. The range to the eastward is pierced by a pass leading to the Dasht-i-Bedaulat. That on the west gradually lessens in height towards the upper extremity, and takes here a more direct northerly, or even N. by W. course. It is not connected with the ranges

which bound the Kanhee valley on the west, but, subsiding to the level of the valley, forms a broad pass, through which a road leads to Nooshky, and by which a small river leaves the valley.

To the N.W. it is bounded by the southern base of the great Cheheltan range, and to the south a slightly elevated and rugged tract of ground separates it from the valley of Mungochar.

Its elevation is about 5,000 feet above the plains of Kutchee. Its slope is a gentle one to the northward, its soil light and rather sandy, of many feet in depth, and is extremely fertile when irrigated.

There are two small rivers running through the valley. The first rises near Mobbee from the base of the hill, separating it from the Dasht-i-Bedaulat. It runs in a S.W. course past Mobbee and Teeree, and then west, in the direction of Nooshky.

Water.

The other—named Doorusoonah in the maps—rises, by many little streams from the hills, at the southern end of the valley, and is fed by others coming down on both sides from the hills which bound it. It runs northward, and either joins that first spoken of, or pursues a course of its own out of the valley through the westerly pass.

The *kurezes* are very numerous, and afford a very plentiful supply of water to the town of Moostung and surrounding villages, fields, and gardens. The streams continually issuing from some of these are from two to four feet in breadth, and one to one-and-a-half in depth. The water is pure, clear, and cool at all weathers, and, contrary to that of the rivulets, appears to depend but little on rain. The *kurezes* are, in some cases, two, or even three, miles in length, having shafts about every hundred yards. They are situated at varying depths from the surface; commencing near the base of the hills at a depth of 15 to 20 or more feet; they gradually near the surface, and issue in the neighbourhood of the town; where they pass under low hills, their depth is, of course, proportionally increased. They are rarely bricked, and pass through either sandy clay or gravel. Wells are rarely, if ever, used.

The view obtained on entering the valley from the north, where the path crosses an elevated ridge, is very beautiful; southward, the valley stretches as far as the eye can see, covered with verdure; on the right towers Cheheltan, and bounding the valley on each side are long mountain-ranges.

The towns and villages are marked by groves and orchards, and the little stream rising at our feet meanders through the valley until lost in the distance.

The town of Moostung is situated about 12 or 14 miles from the extreme northern end of the valley. It is walled, and possesses the remains of an old fort, slightly raised above the rest of the town, built of sunburnt bricks, and at present inhabited by the governor. It has a bazar, moderately well supplied. No meat is sold here; the natives kill a sheep as required, and divide it amongst a small party. The town may, perhaps, contain about 400 houses. It is entirely surrounded by gardens and orchards; indeed, in the distance, appears to be buried in trees. They are enclosed by mud walls about six feet high, forming a perfect maze of narrow lanes, overhung by branches of mulberry, apricot, peach, and apple trees. Large masses of vines hang pendent over these, and climb to their very tops; these branches often cross the road, and form a delightful shade. Purgawad is a large village, very pleasantly situated, about six miles to the north of Moostung. It is also surrounded by gardens and orchards. There are other small villages to the southward, as Sir-i-ab, Ammula, and Gooroo. At Sir-i-ab is kept the stud of breeding mares belonging to the Khan; the village is conveniently situated near the little stream, and is surrounded with cultivation.

The climate of Moostung I have already described in my meteorological report of the summer season of the hill country; but I may here state that it is considerably warmer than that of Quetta and Kelat.

The valley is exceedingly well cultivated, especially in its northern half.

Large quantities of lucerne are grown, five or six crops being reaped from a single field in the season. It is highly manured, and well irrigated. There are great numbers of *paleezes*, or

enclosures, in which melons are grown. These consume a great quantity of water, as they require to be perpetually irrigated. The ground is thrown up into short ridges, on which the plants are grown ; these are divided by gutters, supplied with water by a small canal, leading from some neighbouring kurezes. The melons of Moostung are celebrated for their size, flavour, and profusion. Wheat and barley are largely grown; the crops are rich and heavy. Tobacco and madder are also cultivated, and a small quantity of rice. Juwaree, millet, &c. are also met with, and various esculent plants, as mangel wurzel, turnips, the egg-plant, &c. &c.

The fruits of Moostung are deservedly famous: apricots and peaches are grown in vast numbers, and large quantities of them are dried and preserved for winter use. Mulberries, both white and black, the latter of large size and delicious flavour; quinces, apples of various kinds, pears, figs, almonds, pomegranates, and grapes. Of these there are the following five varieties: 1*st*, a fine long white grape, measuring $1\frac{1}{4}$ inch and weighing eighty grains, fleshy, and resembling an English hot-house grape; 2*nd*, a smaller one of peculiar shape, resembling a pear; 3*rd*, an oval one of ordinary size; 4*th*, a small oval one having no seeds—the flavour like that of the muscatel grape; and 5*th*, a large purple grape. The small one with no seeds is dried and sold as raisins, called khismish.

Geology.

The hills are made up of the same light-coloured limestone before spoken of, extremely hard and fine in texture, veined with thin seams of carbonate of lime. I did not penetrate far into the ranges, but I could distinguish no fossils as far as I examined the rock. The strike, as before said, was N.N.E. by S.S.W., and the dip about W. 40°.

The principal tribes that inhabit the valley and town are the Raisini, Sherwani, Mahmudshi, Bangalzie, and Lorie, with a few Dehwars.

The Dasht-i-Bedaulat is an elevated valley, or plain, situated to the N.E. of Moostung, at the head of the Bolan Pass. Its diameter is from 15 to 20 miles, and its boundaries have been given when speaking of the geology of the Bolan Pass. It has no towns or villages, but is occasionally dotted with the tomans of the Kard tribe.

Some portions of it are cultivated in the spring and summer months; but during the winter it is a bleak, howling wilderness, destitute of trees, or any shelter; the snow lies deep on it, and cold winds whistle over its frozen surface.

It is subject to the depredations of the Kaka tribe of Affghans, and caravans are frequently plundered by them. In the summer it is clothed with the fragrant terk plant, and its surface diversified by fields of waving grain. It has no streams, but one or two wells have been dug, and water obtained with some difficulty; the cultivators are dependent on rain and heavy dews.

Valley of Mungochar

Is a valley situated to the southward of that of Moostung, more circular in form, and of much less extent; destitute of trees, save a few stunted mulberries. Its surface, broken up by an extraordinary number of kurezes, and sprinkled with the tomans of wandering tribes and a few half-ruined villages, is wanting in the beauty which characterises its sister vale.

It is about 28 miles N.N.E. of Kelat. There are some eight or ten mounds in the valley, bestrewn with broken pottery, evidencing them to cover the ruins of former cities. It is well watered, and was covered with crops of wheat, lucerne, tobacco, &c.

The valley is surrounded by hill-ranges of medium height. To the eastward are visible three parallel ranges, which have the general N.N.E. direction. To the northward, a low ridge, over which the road passes, separates it from the southern extremity of the Moostung valley. To the south and west are other ranges, having the usual direction. The outline of the ranges is much more broken and uneven than those before met with, a continuous line being seldom distinguishable. The floor of the valley is about 200 feet higher than that of Moostung.

Geology.

To the E.N.E. is a mountain, second only in height to the Cheheltan, called Kohimaran, or Hill of Snakes, from the vast number it is said to contain. Its strata dip W. or W.N.W. As it is a considerable distance from the valley, I could not ascertain its structure. The hills to the

E.S.E. are from 150 to 300 feet high. Strike N.N.E. by S.S.W.; dip W. about 40°. On examining them, I found them to consist of a compact, fine-grained, white limestone, containing casts of nummulites in carbonate of lime. These strata passed into others composed of pure, fine-grained white limestone, containing no trace of any fossil. On following up several nullahs strewed with pebbles, I found much larger specimens of nummulites in a limestone of a light-red colour.

The ranges to the north are the southern terminations of the ranges bounding the Valley of Moostung on the west.

There were several minor ranges broken and separated by narrow valleys.

I reached a scarped face about 200 feet high, and found it to consist of hard, compact, blue limestone, containing seams of carbonate of lime of various thickness; no fossils, but in the boulders lying scattered over the nullahs leading up the gorge, I found casts of shells in carbonate of lime, similar to those mentioned as existing in the gorges of the hills bounding the Valley of Quetta. I also found, on breaking up some masses, casts of a Spatangus and of a small bivalve.

The investigation was necessarily hurried, and I regret that I was unable more fully to examine these ranges and those towards the S.W., as I believe the rocks comprising them belong to strata transitional between the nummulitic and those formations underlying it.

Valley of Giranee.

The valley of Giranee is situated south of Mungochar and is distant about 8 miles from Kelat. The road from the former place winds, at first, amongst low hills of nummulitic limestone, by narrow gorges and along the beds of nullahs, and emerges on the northern extremity of a long, narrow valley, bounded by parallel ranges of considerable height. Quantities of wild lavender and other labiate plants grow in the stony beds of the water-courses. The valley was covered with the fragrant terk plant; at its end the path crosses a stream of water and enters the valley of Ziaret.

The height of the Giranee is about 6,600 feet; on the east, a low broken range divides it from the northern prolongation of

the Kelat Valley; and on the west a range of considerable height separates it from the valley of the Ziaret.

It contains a beautifully clear stream of water some 8 or 10 feet broad and 2 deep, which, flowing across it, enters a gorge in the western hills, and is probably expended in irrigating the Ziaret Valley. Its banks are fringed with weeping willows, labiate plants, and many English herbs and plants, as the dock, plantain, mallow, &c. &c. I also observed one or two of umbelliferæ and solanaceæ. The stream contains great numbers of fresh-water crabs, and, as I afterwards ascertained, a few leeches. It turns several flour-mills. Hares abound in the valley northward, and large flocks of blue pigeons haunt the kurezes. There is a small mud-built village near the stream, surrounded by some cultivated ground, but the greater portion of the valley is stony and rough.

The inhabitants are few, and confined to the village above-mentioned.

Valley of Ziaret.

The valley of the Ziaret is situated to the westward of, and runs parallel with, the preceding; is of considerable extent, well watered, and cultivated. In it are a few scattered clumps of trees. It contains a village where the Khan's stud of stallions is kept. Near the village is the Ziaret, or Holy Place, which gives the name to the valley. It consists of an old tower, built of sunburnt brick, surmounted by some tattered flags. The lower portion appears to be solid, and a series of steps is cut on one side. Close by is the rib of a whale, reared up on one end, on which the natives look with much veneration and wonder. It is said to have been, and of course was, brought from the sea-coast.

The story connected with the Ziaret is as follows:—In olden times a fair young virgin, being pursued by Kaffirs, who sought her life, fled, and on arriving at this spot, her strength failing her, she sunk miraculously into the earth, and is supposed to be there still; whereupon the true believers erected the present tower on the spot, to commemorate the wonderful story of the Divine interference.

The high road from Kelat to Kandahar passes through this valley, which is bounded on the west by a much higher and bolder range than that on the east. It presents a scarped face, and the strata are apparently horizontal, probably, as usual, dipping to the west. Scattered over the ground are numerous small boulders of nummulitic limestone. The valley is lower than Giranee, and appears to receive its surplus water after heavy rain, a broad pebble-covered nullah leading into it through the gorge which forms the entrance to the valley from Giranee.

Valley of Chappar.

The valley of Chappar lies westward of the Ziaret, and extends from the vicinity of Kelat to that of Mungochar. It is, therefore, of considerable size; it contains the village of Chappar and other small hamlets.

In it is a good deal of cultivation, and as it produces its crops of melons later than those of Khelat Valley, it is able to supply them at a convenient time. It receives the surplus water of the Kelat, Giranee, and Ziaret valleys, after heavy rain,—the drainage of the country west of Kelat tending westwards.

It is bounded on the western side by parallel ranges of mountains, the mountainous tract continuing, with occasional valleys, until the desert of Seistan is reached.

To the southward it opens into the Rodinjo Valley, being partially separated by a broken range of hills. The valley is about six or seven miles in breadth.

Valley of Kelat.

We now arrive at the valley of Kelat, the most southern division of the province of Sarawan, and whose chief town is the capital of Beloochistan. The valley is about eight or nine miles in length, and from one-and-a-quarter to two miles in breadth. Kelat and its dependencies (the surrounding villages and valleys) are sometimes considered as a distinct and independent tract. It is under the personal jurisdiction of the Khan.

The capital, Kelat, is situated about its centre, in Lat. 29° N. and Long. 66° 40, E.

Boundaries.

To the eastward are the great ranges dividing it from the plains, and scattered amongst its mountain ridges are various small valleys inhabited by a few Brahooee tribes. To the westward is a series of low and broken hills, bounded in the background by a much higher range called the Siakoh, or Black Mountain, and towers the northern end of the valley—a low range separating it from the valley of Giranee. Southwards it is bounded by the approximation of the hills, a narrow pass only remaining, overhung by a conical hill to the eastward, 1,100 feet in height. Its level is about 7,000 feet above the sea, and it is the highest valley of any importance in the mountain tracts. The valley slopes gently to the northward.

Soil.

The soil is of the same character as that already described, only requiring irrigation to be very productive.

Water.

It has one permanent stream, six or eight feet in breadth, which rises from the base of a limestone hill on the eastern side of the valley, opposite the town. The water is perfectly clear and pure, and its quantity apparently uninfluenced by rain. After being conducted some few hundred yards, the stream is artificially divided into three principal rivulets, by whose further sub-division the valley is plentifully irrigated. Its source is probably in the base of the mountains, as it is stated to be always delightfully cool in summer, and warmer than the air in winter. Pottinger makes a strange assertion to the effect, that it is warm all night until sunrise, when it suddenly becomes quite cold, the truth being, that the water is of an equable temperature, but by contrast feels warm when the air is cold. I examined it one frosty morning when the temperature of the atmosphere was 44°; 800 yards from the spring-head, the water of the stream had a temperature of 60°, whilst in a frozen pool close by, the thermometer fell to 33°. Three hundred yards nearer the spring, the temperature was 62°, and at the spring itself 64°, feeling very warm to the hand when immersed. From the fact of its preserving its warmth so far from its source, the natives have erected many enclosures over the stream, at various spots, for the purpose of bathing. The narrow cavern from which it

issues is continued some distance into the rock, and is sufficiently high to allow of a man's standing erect.

There are several kurezes in the northern part of the valley, and amongst the low clay hills to the westward are numerous wells, where the water is obtained within a few feet of the surface. Down the centre of the valley runs the dry bed of a water-course, some fifty yards broad, covered with boulders and pebbles. After a heavy storm of rain in the hills—an occurrence which sometimes takes place in summer—a body of water, swelled by innumerable rivulets from the mountain gorges, rushing down the valley, entirely fills this bed, and presents a stream thirty to fifty yards broad and two to three feet deep. It rapidly drains off, and twelve hours are usually sufficient for its entire dissipation.

The town is situated on the northern spur of a hill of limestone, called the Shah Mirdan. The strata have a dip to the eastward, and a scarped face to the westward ; the town therefore is built in terraces, and is entirely exposed to view from the valley in every part. The streets, if such they may be called, are extremely narrow and tortuous. The town is said to contain about 400 houses, but many are in a state of great dilapidation, and several entirely ruined. It is square in form, and walled with bastions at intervals ; it has three gates, looking north, south, and east : the northern one, or Moostung gate, was the one forced by the English, and which still bears the mark of their cannon.

Overhanging the town is the miri, or fort, the palace of the Khan. It is an imposing and antique structure, probably the most ancient edifice in Beloochistan, owing its foundation to the Hindoo kings who preceded the Mahomedan dynasty. From its durbar-room, which has an open balcony, a most extensive view is obtained, commanding the whole valley and surrounding hills. From it the Cheheltan mountain is distinctly seen some eighty miles distant.

Outside the walls of the town are the quarters for the Babees, and the centre of the valley to its front is thickly sprinkled with houses, gardens, and orchards, principally inhabited by Patans ; indeed, it would be difficult to find room to encamp 500 horses in any one spot.

In the southern part of the valley are a few villages surrounded by orchards. The valley is well cultivated and systematically irrigated, and divided off by ridges of earth into melon-beds, fields, and gardens. Each field, or enclosure, is so accurately levelled, that, when irrigated, the water may be evenly distributed, and consequently the fields form a series of level terraces, extending through the length of the valley. Wheat, barley, millet, juwaree, &c. are produced in full crops, and large quantities of oosposht, or lucerne, are grown. Turnips, carrots, lettuces, radishes, onions, beetroot, tobacco, egg-fruit, and cucumbers, are cultivated in the gardens. Melon-beds are numerous, and in the season this fruit, of which there are many varieties, forms a staple food of the lower classes.

In the gardens are found most of the fruit trees mentioned as seen at Moostung. The mulberry tree is the most prevalent, but peaches, apples, quinces, figs, plums, and grapes, are very plentiful. The white and weeping willows fringe the streams, and the plane tree is frequently seen.

Climate.

I have already spoken of the climate of the summer months in the meteorological report.

The winter, which commences about the end of October and lasts until the middle or end of February, or even later, is exceedingly severe. Bitterly cold winds prevail, attended by heavy falls of snow. The frosts are severe and continued. The inhabitants, for the most part, rarely await its arrival, but descend into the milder climate of the plains. The wandering tribes first move off, and these are speedily followed by all who have no urgent obstacles to their emigration. The Khan and his Court adjourn to Gundava, and await the return of the summer.

Fodder.

Horses and cattle are usually fed on the straw of wheat and barley, called *bhoossa* by the natives, and to this is added a certain amount of lucerne, either green or dried. Little or no grain is allowed them, the lucerne being sufficiently stimulating. Grain is not obtainable, unless imported from the plains, but barley is to be had at a reasonable price.

Firewood.

Firewood is obtained from the neighbouring mountains, the higher ranges of the Kerhoor being covered with a species of juniper. It is brought to Kelat on the

backs of camels, bullocks, and donkeys, and the journey takes from two to three days.

Inhabitants.

The inhabitants of Kelat and Beloochistan may be comprised under four divisions, viz. Brahooee, Belooch, Dehwars, and Babees; beside which there are a few Hindoos, who are found at Kelat for the same reasons which induce them to settle in Sind, Affghanistan, or elsewhere, as emigrants from their own country. The Belooch and Brahooee form the bulk of the population of Beloochistan; as a rule, the former inhabiting the skirts of the mountain ranges and the plains, and the latter the mountain districts.

As Kelat may be said to be the head quarters of these people, and as the Brahooees are especially found in the mountainous provinces of Sarawan and Jhalawan, I shall proceed to give a short sketch of them, premising that I draw much of my information from the works of Pottinger and Masson, to which I would refer any who wish to obtain a more extensive knowledge of the subject.

I should also mention that the Political Agent, Major Henry Green, has lately made a compilation of all that is known of the subject amongst the better informed natives themselves, and has thus produced a standard work on a matter of the greatest interest. Pottinger states as follows:—

" They are divided into two great classes, severally known by the appellation of Belooch and Brahooee, and these again sub-divided with such an infinite number of tribes, who take the name from the most trivial circumstances, that it is morally impossible to account for them. The chief under whom they serve, the district or country to which they belong, or the traditions whence they derive their descents, are the most common designations they assume. The Beloocheekee partakes considerably of the idiom of the Persian; and at least one-half of its words are borrowed from that language, but greatly disguised under a corrupt and unaccountable pronunciation. The Brahooeekee, on the contrary, is so dissimilar in its sound and formation, that I never recollect to have marked in it a single expression in any way approaching to the idiom of the Persian. It contains a portion of ancient Hindoo words. The contour of the people

of these two classes is as unlike, in most instances, as their languages, provided they be descendants of a regular succession of ancestors of either; but the frequent intermarriages which take place amongst them have tended in such a degree to blend together the peculiar characteristics of both, that in many families, and even whole tribes, they have ceased to exist." * * * * *

"The Beloochees branch, in the first instance, from the original class of that name, into three principal tribes, called Nharooes, Rinds, and Mughsees. The Nharooes principally inhabit that portion of Beloochistan which lies to the westward of the desert, and there are likewise khiels of them at Nooshky and in Seistan.

"The Rinds and Mughsees are settled in Kutch Gundava, to which fertile plain they have emigrated at different periods from the province of Mekran, and have become incorporated with the Juths, or cultivators of the soil, as the subjects of the Khan of Kelat; a few of these likewise reside in the hills to the N.E. of Kutch Gundava and skirts of the desert north of Kelat. The sub-divisions of the Nharooe tribes amount to about ten, and those of the Rinds and Mughsees each amount to double that number.

"The Brahooees are also divided into an indefinite number of tribes and khiels, and are a still more unsettled and wandering race, always residing in one part of the country during summer, and emigrating to another for the winter season; they likewise change their immediate place of resort many times every year in search of pasturage for their flocks—a practice rare among the Beloochees. They differ so much from the Beloochees in external appearance, that it is almost impossible to mistake one for the other. The Brahooees, instead of the tall figure, long visage, and raised features of their fellow-countrymen, have short, thick bones, with round faces and flat lineaments; in fact, I may assert, that I have not seen any Asiatics to whom they bear any resemblance, for numbers of them have brown hair and beards. The Kumburanees, the chief tribe, regarding which there is a peculiarity, viz. that of being divided into three distinct gradations of rank, called Ahmedzyes, Khanees, and Kumburanees. The first supplies the Khan; the Khanees are of the secondary rank of chiefs. The word Kumburanee includes all the

remainder of the tribe, but in common is applicable to the whole body. They receive wives from, but do not marry their daughters into, other tribes."

He thus speaks of the original settlement of the Belooch and Brahooee tribes in the country :—

" Ninety-two years after the epoch of the Hejira (A. D. 677), the Kaliphas of Bagdad, incited by the combined motives of zeal for the Mahomedan faith, and desire to revenge the insult that had been offered to their dignity by the idolators of Sind, despatched an army against that kingdom, by the same route that the Macedonian hero had selected on his return to Babylon nearly one thousand years before. This force is expressly stated to have kept close to the sea-shore, that it might be certain of a supply of water, which is always procurable by digging a foot or two deep in the sandy beach ; it consequently knew nothing of the inland regions, nor was any attempt made, as far as I can learn, during the administration of the Kaliphas of the houses of Oomyuh and Abbass, to explore them. When Mahomed, the successor of Subuktaghi, the first Sultan of the Ghaznuwee dynasty, turned his arms towards India, he subjugated the whole of the level district west of the Indus to the very foot of the Brahooee mountains. His son, Musaood, extended these conquests still more westerly into Mekran ; he adhered, however, to his father's plan of not ascending the lofty ranges, and all subsequent invaders of Sind seem to have been guided by their example. This is ascribed to two distinct causes,—the poverty and the imperviousness of this tract. The former was so well ascertained at an early date, that the compiler of the Chuch Namah states that those infidels who would not conform to the doctrine of the Koran were driven to the mountains, there to perish by famine and cold. Wilds thus spoken of, I presume, were void of people, and from this epoch I shall hereafter fix the first regular settlements to the provinces of Jhalawan and Sarawan, or, at least, their most elevated districts. We now arrive at a period when some indistinct memory of historical events of Beloochistan begin to be orally preserved.

" The Beloochees ascribe their origin to the earliest Mahomedan invaders of Persia, and are very desirous of being

supposed to be of Arabian extraction. They spurn the idea that they are derived from one stock with the Affghans. The affinity of the Beloocheekee to the Persian language affords of itself strong evidence in favour of this position (viz. that they came from the westward), to back which, we still see that the majority of the Belooch nation still dwells on the western frontier; but as neither their features, manners, nor language, bear the slightest similitude to those of the Arabs, I reject them totally. In the beginning of the fifth century of the Hejira, the Seljuke Tartars appeared in Khorasan, and, in the short space of ten years, wrested that kingdom from the house of Ghaznavi. It was ceded to Alp Arslan, and constituted a part of the Seljukide dominions, until the extinction of that race, about 150 years posterior to Togrul Beg having assumed the title of emperor. Within the lapse of time, the Beloochees are alluded to both by that general term and particular tribes, and as dwelling in the very districts which they people at this hour. * * * *

"We learn from the Greek and Asiatic historians that, as these armies became dismembered, either by the death of their generals or a defeat, the barbarians who composed them wandered over the country until they found an advantageous place to fix themselves, or entered the service of some more fortunate chieftain than their own as mercenaries. Such, in my opinion, was the case with the Beloochees, and that they are of Turkoman lineage, various circumstances go to prove. Their institutions, habits, religion, and, in short, everything but their language, are the same; this last anomaly is easily explained. The Seljukes had long settled in Persia, where they naturally adopted the colloquial dialect, and brought it with them on their expulsion by the Kharizmian kings. The unremitting enmity of these kings forced vast hordes of them to fly from Persia after they had been colonised there for many years. The fugitives are said to have gone to Seistan and the neighbouring countries, which are those of Sind, Seistan, and the Brahooee mountains.

"The Rinds—one of the principal divisions of the Belooch tribes—have a tradition that they came originally from Aleppo.

"The Brahooees appear to have been a nation of Tartar mountaineers, who settled, at a very early period, in the southern

parts of Asia, where they lived an ambulatory life in khiels, or societies, headed and governed by their own chief and laws, for many centuries; and at length they became incorporated, and obtained their present footing at Kelat and throughout Beloochistan by an event I shall presently describe. It is impossible to form more than a supposition what was the nature of the region from which they emigrated, but their pursuits and way of domestic life afford the strongest reason for believing that they were originally mountaineers; and some amongst them affirm that the very name demonstrates this by its signification being a compound of the affix *baon* and *roh*, a word said to mean a hill in the dialect still spoken in some parts of Thibet; such reasoning, however, is not entitled to any great dependance, though supported by the collateral evidence of the Beloochees, being called in one quarter of the country Nharooes, which, if we admit the former derivation, means "lowlanders," *i.e.* literally *not hill-men*—a name they received from the Brahooees when they came amongst them, and evinced a preference for the champagne districts, low valleys, and plains. The Brahooees imagine themselves the aborigines of the country."

In another place he states, that he considers the Hindoos to have been the first colonisers of the upper part of the Brahooee mountains, and that the Brahooees gradually settled amongst them. That the last Hindoo rajah was named Sehwa, who called in the aid of these mountain shepherds against a horde of depredators from the western parts of Mooltan, Shikarpoor, and Upper Sind; and that the Brahooees, having defeated and driven off these invaders, deposed the Rajah Sehwa, and seized the government for themselves—a chief of the name of Kumbar becoming Khan of Kelat, of whom the present Khan is a lineal descendant.

The foregoing would, I think, lead us to suppose—1*st*, that the original inhabitants of the country were Hindoos, who fled from the conquering Mussulmans who invaded Sind, Lus, and Mekran, A. H. 93; 2*nd*, that the Brahooees were Tartar mountaineers, who gained a footing in the country, and ultimately supplanted the former, becoming the ruling race; 3*rd*, that the Belooch came from the westward, but whether

they were Seljuke Tartars, or Arabs from Aleppo, is a matter of doubt.

Now Dr. Latham classes the Belooch nation with the Persian, but considers them as a modified form. He says, "E. and S.E. of the proper Persians of Kirman, come the Belooch of Beloochistan. There is certainly a change of type here : physically the country is much like the table-land of Kirman. India, however, is approached, so that the Belooch are frontier tribes, to a certain extent they are encroachers. We find them in Sind, Mooltan, and in the parts between the Indus and the Suliman mountains and in the middle of the Suliman mountains themselves. They style themselves 'Usul,' or the pure—a term which implies either displacement or intermixture in the parts around. Their language is a modified Persian. Hindoo features of physiognomy now appear. To domestic elements of polity and social constitution, we have tribes, clans, and families, with divisions and sub-divisions. We have a criminal law which puts us in mind of the Levites. We have classes which scorn to intermarry,—and this suggests the idea of caste. Then we have pastoral habits, as in Mongolia. The religion, however, is Mahomedan; so that if any remains of the primitive paganism, available for the purposes of ethnological classification still exist, they lie too far below the surface to have been observed" ; and again, "the hill range between Jhalawan and Sind is occupied by a family which has commanded but little notice ; yet is one of the most important in the world—the Brahooee. The language of the Brahooee belongs to the Tamulian family. The affinity by no means lies on the surface, nor is it likely that it should. The nearest unequivocally Tamulian dialect, on the same side of India, is as far south as Goa ; supposing them the original continuity, how great must have been the displacement !"

If Rask's great theory be the correct one, which makes all the fragments of natives speaking a Tamulian dialect parts of one great continuous whole, which spread in the earlier ages over India and Europe, underlying the more recent system of Celtic, Gothic, Slavonic, and classical nations—1*st*, Europe and the Indo-Germanic of India, as the primary strata in geology underlie the secondary and tertiary, but cropping out, or being

exposed here and there, are the fragments of natives—of Laps, Finns, and Basques in Europe, and of the Cuchwarees, Cohatees, Tudas, Ghonds, Khonds, Lars, and other mountaineers of India; if, I say, this theory be the correct one, then the Brahooee, being of the great Tamulian family, would be the *aboriginal* inhabitants of the country.

I am certainly inclined to adopt *this opinion*, and that they were driven out of India by the invading host of the Aryas from the north-west, but probably not before they had adopted the Hindoo religion, which subsequently they had exchanged for the Mahomedan. This would account, in some measure, for the total absence of any trace of their original belief,—the primitive paganism of India. At the same time, it is not impossible, or unlikely, that, at a later period, the Hindoos might have had a settlement in the valley of Kelat, whilst the Brahooees inhabited the mountain fastnesses as wandering shepherds, feeding their flocks in the less accessible valleys; and this idea is strengthened by what is afterwards stated by Pottinger, viz. "that they (*i.e.* the Kumburanees after their accession to the government) did all in their power to incorporate the wandering shepherds into tribes, rewarding those who acceded to this plan with large tracts of land free of taxes, or any kind of stipulation, save that of acknowledging the paramount authority of the head of the Kumburanees, and furnishing them with quotas of "troops"; and, lastly, that the Belooch had much more recently gained a footing in the country by encroachments from the westward, probably issuing from Persia, there being good reason to consider them of Arabic origin. The distinctive character, habits, and language of the people bear out this theory, which is further strengthened by the fact of the Brahooees being confined to the mountain districts, to whose fastnesses they had fled when dispossessed of the plains, as the Kelts of England fled before the Saxons and took refuge in Cornwall and Wales; and as the Saxons fled, in their turn, before the Normans, and hid themselves in the fens of the midland counties.

But having admitted the priority of the Brahooees, it is not to be supposed that they, as at present existing, are all traceable to one clan, or *all* belonged originally to the same family. They

are undoubtedly composed of many races, which have been added to the general community from time to time, and have become incorporated among the Brahooee tribes.

Thus the Koords, who inhabit the Dasht-i-Bedaulut, doubtless came from Koordistan, probably amongst the followers of some Mahomedan invader of India, and, perhaps, laden with spoil, preferring, on their return, to settle where they now are, rather than continue their march to their own country, made choice of the Dasht-i-Bedaulut. Again, many of the Jhalawan tribes are undoubtedly of Rajpoot origin; and until lately, the practice of infanticide was prevalent amongst them. Near Bagwana is a cave in the rock filled with the dried mummy-like bodies of infants, some of which have a comparatively recent appearance.*

The Sacæ, who formed part of Alexander's army, and whose country is stated by Wilson to have been that lying between the Paropamisan Mountains and Sea of Aral, still exist as a tribe of the Brahooees of Jhalawan. It is not improbable that they accompanied Alexander as far as the south of Sind, and, returning with Craterus up the Moolla Pass, settled in their present position.

The Beloochees also have by no means a pure and unbroken descent from any one source. Adopting Pottinger's theory, that the main body were Seljuke Tartars driven out of Persia, as he describes, yet, undoubtedly, many are of Arabic descent.

Nor do I think, with him, that the Beloochees have no resemblance in any way to the Arabs. On the contrary, in many cases the outline of their physiognomy is very similar to that of the Arabs of Egypt and Syria ; and if such a Belooch was dressed in the Arab dress, it would be exceedingly difficult to detect his nationality.

Others are Sindians who fled to the hills on the invasion of their country by the Mahomedans. The original Hindoo inhabitants of the Murree and Boogtee hills were driven out by their present occupants, but the natives of Barkhan (the Khetrances), inhabiting the more mountainous district to the northward, were able to hold their own, and although they eventually became

* For this, as well as for much other information on this and other subjects, I am indebted to the kindness of Major Henry Green, Political Agent.

Mussulmans, yet they still retain some peculiarities, as, for instance, not performing the rite of circumcision. In point of civilisation, the people are far behind their neighbours—the Persians, or even the Affghans. They are truly a pastoral race, and the description which Strabo gives of the islanders of the Cassiterides would apply pretty aptly to them :—"One of the islands is a desert, but the others are inhabited by men in *black cloaks, clad in tunics* reaching to the feet and girt about the breast. Walking with staves, and *bearded like goats*, they subsist by their *cattle, leading*, for the most part, a *wandering life*." As before stated, they are collected into families, khiels, and tribes. Each tribe has its head, and the tribes of Sarawan and Jhalawan are respectively under the leadership of two chiefs, who hold a high position in the country, and sit, the one on the right hand, and the other on the left of the Khan in durbar. The first is named Moolla Mahomed, and the other Taj Mahomed.

The whole are nominally subject to the Khan as chief of all, but his power appears to vary with his popularity. The tribes reside in tomans, or collections of tents (and here I especially allude to the Brahooee mountaineers). These tents are made of goats' hair, black or striped ; the furniture is very simple—a few metal cooking-pots, a stone hand-mill, and some rough carpets or rugs, with a distaff for spinning wool, and a hookah, are all that are usually found in a Brahooee tent.

That of the chief may, perhaps, be better furnished, and he is richer than his neighbours in flocks and herds.

The dress of the lower orders is made up of a long tunic, trousers loose at the feet, and a black or brown great-coat, or cloak, usually of felt, a kummerbund and sandals. They wear a small cap, either fitting tight to the outline of the head, or dome-shaped, with a tassel on the top. Those of the higher classes are elaborately ornamented with gold thread.

A few wear turbans, and the Belooch have them preposterously large, of white muslin. The higher classes are somewhat better dressed, and all carry loongees, or scarfs, which they throw around their shoulders in *exactly* the same manner as a Scotchman wears his plaid, and strangely enough as the ancient Irish or Hyperboreans, wore them ages ago.

"When Abaris was sent as an ambassador to Athens, he came not clad in skins like a Scythian, but with a bow in his hand, a quiver hanging on his shoulders, *a plaid wrapt about his body*, a gilded belt encircling his loins, and trousers reaching from the waist down to the soles of his feet."

The men wear their hair long and flowing over the shoulders, whilst a luxuriant beard falls over the breast. The women tie theirs in a knot behind, brushing it smooth in front, and keeping it in place by a species of "fixature." The colour of the hair is frequently brown or red, and many of the natives have an European cast of countenance, in some cases closely resembling the Irish. The women wear a long gown reaching to the feet, and elaborately worked at the breast. Red is the fashionable colour. Arms are universally carried,—the sharp curved sword, round shield, and long matchlock; and the wealthy expend considerable sums on them; the powder, flints, and all the martial paraphernalia are carried in a great number of small pouches slung to the waist-belt. Always armed, they are ever ready to fight on the slightest quarrel; an appeal is made to arms, and as the debt of blood is held to be a most sacred one, it is ever most rigorously exacted. Thus a quarrel between two tribes is indefinitely protracted, and liable at any time to be renewed. Should a family or tribe lose one or more men in a fight, they never rest until their claim is settled, and they have exacted from their enemies (though perchance relatives) the number of lives in return; and they are by no means scrupulous as to the way in which their object is attained. A man shoulders his matchlock and *stalks* his enemy as he would an ibex, shooting him down whether he be armed or not, or working in his field. There is a feud now existing between two tribes, in which one has already lost 300 men, and the other 120. However, I believe in some cases, by making compensation either in money, land, or cattle, the difference may be settled. The Khan has also the power of settling such disputes by making a personal visit to the house or tent of the exacting party.

At the commencement of the winter months, all emigrate to the plains, and many leave the hill-country as early as the middle of September.

The men of a toman appear to spend their time in looking after their flocks, attending to some little cultivation in their immediate vicinity, and in sporting, of which they are exceedingly fond. The women, besides their domestic duties, spin wool, and weave by hand a coarse kind of carpet and boree, or material for tents. They also prepare a kind of felt by beating wool continuously with water until it is sufficiently matted together.

The inhabitants of towns are, perhaps, somewhat more civilised, attend more carefully to agriculture, and have acquired some of the more useful mechanical acts, as working in iron and copper, brick-making, tanning, dyeing, &c., but no manufactures, as far as I can learn, are carried on in cotton or silk, these fabrics being all imported from Persia, Affghanistan, and India, and sold by Bunniahs. A certain tribe also works in stone, hewing troughs, hand-mills, and vases having some pretensions to beauty of outline, from a blue limestone obtained from the hills near Rodinjo.

The Merdoee, also a tribe living near Khozdar, obtain antimony and lead from the hills of Kappar. The lead is found *native*, in pieces the size of marbles, a fact extremely rare in mineralogy.

The men are hardy and active, as mountaineers would be supposed to be; excellent shots with the gun at moderate distances, and exceedingly fond of field sports; coursing is a favourite amusement, and grey-hounds are very generally kept; considerable prices are very often given for them, and they are carefully trained; many of them would, I should think, stand a very good chance in the well-contested matches of England. Hawking is not so commonly practised as it is in Sind. The mountaineer has a bold, frank manner, but is, nevertheless, respectful and courteous, differing widely, in this respect, from the native of Affghanistan, who returns your look with a rude, insolent stare, and has always a swaggering demeanour and impudent carriage. There is very little wealth among the people, and no ostentation or pretence at display, several of the principal chiefs of the mountain tribes still living in black tents. Those that are liberal to their retainers, and just and upright in their dealings with them, exercise a power and influence over them very similar to that which the baron held over his followers in feudal times.

In traversing the country, a stranger would probably adopt the belief that the inhabitants were both exceedingly religious and cleanly, from the multitude of praying places erected by the road-side, and the enclosures placed over streams for the purpose of bathing; but on a closer intercourse with them, I think he would be quickly undeceived, and would find that a pharisaic spirit lay underneath in both cases. These praying places are placed on the west side of the roads, and are found in great numbers throughout the length and breadth of the land, analogous to the crosses found in Roman Catholic countries. They are merely circular or oblong enclosures of large stones, with an opening on the east, and facing it on the west, one or more huge stones set on end in the centre of the wall. I first saw them near the mouth of the Bolan Pass, but I believe that they are also found in the hill route in Lower Sind. It is said, that whenever the Khan halts on a march, a large one is immediately built for his convenience opposite his tent-door.

The walled enclosures set over streams are much less frequently seen, but exist usually near villages and towns.

Another feature of society pertaining to feudal times exists here in the persons of the wandering bards, who traverse the country, or attach themselves as hangers-on to the establishment of the chiefs. They are wild and picturesque in appearance, are never armed, their sacred character being a sufficient protection; but though they do not fight themselves, they have the power, by their songs, of strongly exciting the martial spirit in their hearers. They carry a rudely-shaped lute, and keep time with their voices to the music. The metre of many of their lays is very peculiar, the verses being generally composed in three lines, the last line is occasionally repeated twice or thrice. They sing the deeds of former heroes, recount the history of hard-fought fights, and imbibing the spirit of their theme, wind themselves up to a pitch of great excitement, and then sinking suddenly into a melancholy chant, close their song.

Agriculture.

The system of agriculture carried on by the natives is simple and effective. A certain amount of attention is paid to the rotation of crops. The fields are divided off by ridges of earth and raised embankments to an

accurate level. They are then further sub-divided longitudinally by ridges which are thrown up about seven paces apart. All this is with reference to the irrigation, which is conducted in a very efficient manner. The land is then ploughed and manured. Fields that have lately yielded crops of lucerne grass are dug up with the spade, the roots of the grass in times of scarcity being used as fodder. Lands that are not irrigated by streams, but are dependent on rain, and the rivulets that come down from the hill-sides after rain are called *khushawah*, and are found scattered about the valleys here and there near the tomans, or encampments of wandering tribes, who plough a piece of land, sow it, and returning to it when the grain is maturing, remain only so long as may be necessary to gather in the crop. The implements used are the following:—1*st*, a plough of wood of very simple construction, consisting of a vertical piece, bent forward at the bottom, and armed with a point of iron and a long horizontal beam, which passes forward between the pair of bullocks who draw it, and is fastened to the yoke. This implement is so light that the labourer may be seen, in the early morning, driving before him his yoke of oxen, and carrying the plough on his shoulder to the place of action. The soil is so soft and yielding, that, simple as the instrument is, it is as efficient as any more costly kind of one could be. 2*nd*, a harrow which is merely a wooden board, six feet long by two broad, and is dragged over the ploughed land by being attached to the yoke with iron chains. If not sufficiently heavy, the driver stands on it, and thus adds his additional weight. It is used also in forming the embankments, being then turned partly on its edge. 3*rd*, a spade, or shovel, which is *exactly* like an English one, and is used in the same way—the man pressing it into the ground by applying his foot to the iron shoulder, and then turning up the sod. 4*th*, a reaping-hook, or sickle, which is also *exactly* like the one used by the ancient Egyptians, as pictured on the sculptured ruins of that country; that is, it is shaped like the English sickle, but is furnished with minute *teeth* on the cutting edge.

Wheat and barley are reaped in July, and the fields are cleaned by the middle or end of August. The land is then ploughed,

and the seed sown in the two following months. The young shoots are eaten down by cattle.

The other classes mentioned as residing at Kelat are the Babees and Dehwars. The first are merchants, who appear to have come originally from Affghanistan; they are considered a wealthy people. The Dehwars are, in all probability, the descendants of the Tajiks of Balkh. Their language is nearly pure Persian; they inhabit *dehs*, or villages, and do not emigrate; are an agricultural people—hard-working and poor.

Geology.

In speaking of the geology of Kelat, it is desirable to recapitulate the boundaries of the valley, and to describe the country immediately surrounding it. I append a sketch-map of this district—scale two miles to the inch—in reference to which it will appear as follows.*

The valley is about eight or nine miles in length. The inhabited or cultivated portion is from one to two miles in breadth, gradually narrowing at the extremities. It is entered by the road from the south; one from the north-west, leading from Giranee; two from the west, leading to Rodinjo; and two from the east,—one a bridle-path across the hills leading to Nichara, and a second to the north of this leading to the village of Sealkoh.

On the eastward is a range of hills about 500 feet in height, dividing it from the valley of Kuttringal, in which the village of Sealkoh is situated. This valley of Kuttringal is about two miles in width, and lies from 100 to 150 feet higher than the valley of Kelat; beyond it, eastward, is the great range of mountains called by the natives Herbooi, the highest ridges of which form the most elevated point attained by the mountain ranges of Beloochistan, probably from 1,800 to 2,000 feet above the valley of Kelat.

Bounding the cultivated portion of the valley to the westward is a series of low and greatly broken ranges of hills, extending about four miles in breadth; beyond these is a high range,

* For this I am indebted to Major Malcolm Green, by whom the survey was made.

bounding entirely the view westward, called by the natives Siakoh, or Black Mountains; they are probably from 500 to 600 feet in height; and beyond them is the valley of Chapper. Partly separating the valley of Kelat from these broken ranges again, is a hill 530 feet high, called Shah Mirdan. On the northern spur of this the town and citadel are built. Southward this hill is continued in a broken range until it joins the high range called Syud-Ali-ke-Tukkur; it separates the valley of Kelat from the northern head of the valley of Rodinjo.

This valley of Rodinjo stretches in a S.S.W. direction for many miles.

It is bounded by the Syud-Ali-ke-Tukkur on the E.S.E., and on the opposite side, first, for six or eight miles, by the Siakoh, and afterwards by a range which lies to the westward of this, where it joins the valley of Chapper. The valley is, perhaps, two to four miles in width for the northern half, but much more extensive south of this.

To the S.E. of this valley is the valley of Tonk, which runs parallel with it, and is bounded on one side by the Syud-Ali-ke-Tukkur, and on the other by a parallel range.

This general outline will, perhaps, convey an idea of the relative situation and boundaries of the Kelat and other valleys around it.

Commencing now from the extreme easterly point mentioned, I shall attempt to describe the geological character of the several ranges; and to assist in the description, I have appended a vertical section, extending across from east to west:—

1*st.*—As before stated, the most easterly point reached was the summit of one of the ranges forming a portion of the great range of the Herbooi. This range is many miles in length; the strike is N.N.E. by S.S.W. It is composed of some five or six ranges, rising one behind the other, until a height of above 2,000 feet is attained (or 9,000 above the sea). The natives imagine it to be continued on to Kandahar. Eastward this mass of mountains stretches in range after range, until the plains of Kutchee are reached about forty miles distant.

The Herbooi are composed of nummulitic limestone; of the same character as that seen in the Bolan Pass.

The strata, in many places, are exceedingly confused, dipping in various directions, but having, as far as I could ascertain, a general easterly dip. The ravines and water-courses are numerous and very deep. The drainage of this face of the hill extends westward, one principal water-course crossing the valley of Kuttringal, passing around the southern extremity of the Sawar hill, and falling into the valley of Kelat. The mountain is covered with plants of the labiate order, with a prickly bush resembling the *beyr* tree, and with a species of juniper, as before stated. Its face is, in some parts, clothed pretty regularly with this tree.

A mountain-pass crosses it to the valley of Nichara, and there are other paths leading up its sides formed by the wood-cutters in their frequent journeys.

2nd.—We now descend into the valley of Kuttringal, which is about two miles in breadth, and eight or nine in length. As before stated, it is some 150 or 200 feet higher than Kelat.

It is partly cultivated at its southern end, and much more extensively so at its northern extremity, where the village of Sealkoh is situated, and which is well supplied with water. The soil is of the same character as that of the adjoining valley. On passing northwards up the valley, we reach a water-course having the same direction. This cuts its way through the alluvial soil; reaching a few miles onward, low hills of clay, red in colour, compact, and dotted and speckled with a light-yellow coloured clay, and covered, in some places, with an efflorescence of salt; further on the clay becomes sandy, forming, in some places, a coarse sandstone, succeeded by conglomerate, about 50 feet in height, loosely cemented by a sandy matrix; the stones composing it are rounded, consisting of nummulitic limestone, white, hard, sub-crystalline limestone and flint. The sides of the low hills, or mounds of clay, were covered by pebbles and boulders of the same character. Rising out of the bed of the valley, I found a stratum of tufaceous limestone, soft and friable.

These deposits, in some places nearly filling up the valley, are evidently of recent origin.

The village of Sealkoh is situated on light-coloured clays, with mounds, or low hills, of the same in its vicinity. The conglomerate ceases south of the village. The water-course

here washes the base of the range bounding the valley to the westward, and, passing through a broad gorge in the same, ultimately finds its way into the Kelat valley.

3rd.—Continuing our section westward, we now reach the range which separates the valley last mentioned from that of Kelat.

It is about 500 feet in height, 2 miles in breadth, and about 8 or 9 in length.

Like the Herbooi, it is made up, not of a single range, but is composed of a number of hills, exceedingly broken and confused, but having a general N.N.E. and S.S.W. strike. The strata on its eastern flank dip towards the valley, or eastward, at about 40°; in the centre the dip is confused, and on its western side again dip east.

The range is composed of nummulitic limestone.

Towards the south, it ends in a hill 1,100 feet high, which, viewed from Kelat, wears a curious and marked aspect, being of a conical shape.

Its strata are nearly vertical, but have a dip, in some places, of 75° or 80° to the *west.*

Many of its strata are exceedingly *brecciated,* the angular masses varying in size from that of a man's head to the size of an acorn. The cement is of carbonate of lime, sometimes in a crystallised form.

This brecciated character of the strata is repeatedly met with in various portions of this range, and of others afterwards to be spoken of. This conical hill, called the Lawar, overlooks and commands the western entrance of the valley of Kelat, the boundary on the opposite side being formed by the northern termination of the Syad-Ali-ke-Tukkur.

Near Sealkoh, the hills of this range are from 500 to 800 feet high. The strata are here very thick, perhaps 8 or 10 feet, much divided by cracks running at right angles to the lie of the strata.

Immense blocks, 10 or 15 feet square, have separated from the higher strata, and cover the ground along the base of the hill.

Probably the same cause that opened the gorge through the range by which the water-course passes, operated to produce this disruption of strata. On the western flank, these hills, opposite the town of Kelat, present a scarped face to the valley, the strata

dipping eastward; and underlying the nummulitic limestone, appears a limestone of a different character—pure white in colour—speckled with dark specks, compact, fine-grained, and hard. It takes a polish like marble under the action of running-water, and would form a most excellent building stone. As far as I could ascertain, it contained no fossil.

4th.—The bed of the valley of Kelat is composed of a light, soft, alluvial soil, containing much calcareous matter, effervescing freely with dilute acid. In some places I have seen salt in efflorescence. Water is easily procured by wells, or *kurezes*, the substratum being clay. Running northward is the bed of the water-course before spoken of, covered by several feet of pebbles, its sides showing, in several places, sections of recent conglomerate.

The pebbles are composed of nummulitic and other limestone and flint.

This water-course, towards the head of the valley, passes through a break in the hills to the westward, crosses the Giranee valley, and runs into the valley of the Ziaret, and so on, in a N.N.W. direction.

I found coloured clays, or marls, underlying, in one place, the white limestone above spoken of on the eastern side of the valley. In it I could find no fossils.

5th.—On the westward of its cultivated portion, we arrive at a range which, for the southern half of the valley, separates it from the valley of Rodinjo; then comes a break opening out into the clay, marl, and limestone series, and north of this another low range separating it from the valley of Giranee; these two ranges being nearly in a continuous line, running north and south.

The southern one is considerably the highest, being about its centre 530 feet high. The hill thus formed is called the Shah Mirdan; and at its northern spur, the town and citadel of Kelat, as before stated, are built. Its strata dip east, and at an angle of 50°, presenting an irregular and scarped face to the westward.

It is composed of nummulitic limestone; much of its strata presents the same brecciated appearance observed in the Lawar.

From its summit is obtained a beautiful and extensive view of the surrounding country. Immediately beneath, at a distance

of 1,000 yards, lies the town, surrounded by the houses of the Babees.

The smiling valley, studded with its gardens, orchards, and cottages, stretches away to the north. On the extreme east the view is bounded by the towering range of the Herbooi, and on the west by the dark Siakoh. To the north-westward, the Parunssar range raises its peaked outline against the sky to the N.E.; above the broken, nearer range the great Kohimaran shows its head (distant 30 miles); and through the northern outlet of the valley, in the far distance, is seen the blue Cheheltan, fully 80 miles to the northward.

Turning now southward, the conical Lawar is seen bounding the valley on the east; the Syud-Ali-ke-Tukkur on the west, and stretching away to the S.S.W. is the valley of Rodinjo; its portion nearest us mottled and diversified by its many coloured clays. Rodinjo, at a distance of 14 miles, is marked by a small clump of trees. The low range north of this divided in the centre, and through the opening runs the water-course westward.

It is composed of nummulitic limestone, but in many portions of the hill the limestone is destitute of fossils. Its strata dip east at 50°. On its eastern flank is a spring of water, strongly impregnated with sulphuretted hydrogen. The place is called Wadi Bahi, and is considered to have a sacred character, both by Mahomedans and Hindoos; a short flight of steps has been cut in the rock leading down to the well, and over it is built a house inhabited by Hindoos and a place for prayer.

6*th.*—Westward of this line, we arrive at the most interesting part of the section. It is about four or five miles in breadth, and composed of admixtures of sand, lime, and clay, forming marls and loams, calcareous clays and argillaceous limestones. The basis is clay, but the outline is broken by low hills of mud and limestone of various character. These low rounded hills have a general strike of N.N.E. by S.S.W.; the strata often being vertical, at other times dipping east and west.

About two miles from the town is a higher range of white limestone, its northern half having a strike of N.N.E., and its southern portion bearing away to the westward and flanking the Rodinjo valley; its strata dip *westward.* The strata are exceedingly con-

torted in many places, and split up into thin shales of half-an-inch in thickness. Interleaved amongst the strata are a vast number of tabular masses composed of flint. In some places, these are in the form of flat nodules with bevelled edges, and about two inches in thickness, but in other places I found the tabular masses of enormous size, extending from 15 to 20 feet in length, and having a thickness of 5 or 6 inches. They are in parallel rows, and reminded me pointedly of the flints in chalk. I should suppose them to be the analogues of those.*

The *clays* are of various colours—purple, green, red, chocolate-brown, and white; and some of them would apparently be admirably adapted for the use of the potter.

The *marls*, distinguished by their containing much calcareous matter, and by falling into minute pieces on exposure to the atmosphere, are similarly coloured. These are very frequently interstratified by argillaceous limestone, which then wears the same colour as the marl in which it is found. Cropping out of these marls, I found an excessively hard, chertaceous stone, slightly, if at all, effervescing with acid, containing small rounded or irregular masses, of the size of oolitic grains, of carbonate of lime, and another mineral, frequently coloured red or green, in a black compact matrix [fine diorite, amygdaloidal, zeolitic]; also, an excessively hard siliceous [arenaceous] limestone, containing traces of nummulitic fossils [small Foraminifera in abundance, but no nummulites],† small green-coloured specks, and particles of siliceous matter. If these be found to be true nummulitic fossils in limestone thus cropping out of clays, which are certainly of the secondary

* Dr. Cook having kindly sent me the collection of geological "specimens" and "fossils," to which he alludes in the next page, for more deliberate examination, in connection with his descriptions of the valleys of Kelat and Rodinjo, I have done so with much interest; and what little I have to state respecting them will be found in brackets in the text, or at the bottom in "foot-notes."

For instance, the "specimens" of flint here mentioned are not the genuine "chalk-flint," but apparently pink and grey consolidated, siliceous limestone, if not veritable chert.—*H. J. Carter.*

† This is an arenaceous deposit, charged more or less with minute Foraminifera, chiefly allied to *Orbitoides.* One of these fossils seems intermediate almost between *Nummulites* and *Orbitoides.* *Operculina* is also present, and

period, it would be presumptive evidence that some portion, at least, of the nummulitic series belongs to the secondary epoch, and thus might assist in settling this somewhat doubtful question. Again, in one spot a mass of black rock, which appeared to be chert [fine, black clay chertified] imperfectly stratified, was found cropping out of the clays. Acids had no effect on it; its fracture was somewhat vitreous. Most of the white limestone is minutely veined with carbonate of lime; and in a light-coloured limestone I found what appeared to be pisolitic iron-ore scattered through its substance. In other places this ore was in the form of nodular masses [brown hæmatite, common in the interior of casts of shells]. In the clay I found a large quantity of crystallised carbonate of lime, and in one spot fibrous gypsum. I have arranged and forwarded specimens of all these and of the fossils found in them; and if they have not been correctly named or sufficiently examined, it has not been from want of interest in the matter, but from the fact that the latter portion of this report has been greatly hurried by our departure from Kelat for the Provinces.

The fossils found in the clays and their contained limestones are the following :—

1*st.*—*Ammonites*, of three or more species.

2*nd.*—*Belemnites.*

3*rd.*—*Nautili*, one very closely resembling *Nautilus truncatus* of the Trias.*

4*th.*—*Orthoceratites*, exactly resembling the description given of *Orthoceras laterale.*

Of the latter I was not sufficiently fortunate as to find a perfect specimen, but the fragments were exceedingly numerous, and from

the "green-coloured specks" appear to be composed of hornblende and other green minerals, (green carbonate of copper ?) from the Dioritic Rocks upon which the series may have been deposited, as the nummulitic series at Muscat.

I have not been able to find any nummulites in it, but have done so in the deposit numbered "7th" in the Valley of Rodinjo, which, it will been seen, is similarly composed, and stated by Dr. Cook to be similarly situated, in this valley.—*H. J. C.*

* This is not *Nautilus truncatus*, though like it.—*H. J. C.*

putting them together in the order they would appear to follow, I should think the individual attained a length of from 3 to 5 feet.

Each section is cylindrical, gradually tapering and concavo-convex. The syphon not central but lateral, and usually very well marked;—regular in its outline, and containing no bulgings. The largest segment measured something more than two inches in diameter, and the smallest half-an-inch. It is stated that *Orthoceras laterale* is only found in the mountain limestone, and *not later* than the carboniferous period. *If such be true*, either these clays must belong to the *primary* period, or the fossil is not rightly named.* This series, in all other respects, so greatly resembles those of the secondary epoch, that I should not have felt any doubt in the matter had not this fossil created it.

7*th.*—Westward, the clays are bounded by a high range (the Siakoh) of dark-gray limestone, excessively hard. The strata sprinkled, and in some places almost covered on their surfaces with nodular masses of *flint*. These masses are black and shining externally, and have frequently in their centres calcareous matter. Dip nearly vertical in some places, in others 65° to 70° E. Strike of northern half of the range N.N.E. by S.S.W., the southern portion trends more westerly, and has a strike of W.S.W., here bounding the Rodinjo valley. I found no traces of any fossil in this rock. The range is about a mile in breadth, with masses of broken hills on the west of it.

8*th.*—Beyond this (westward) the nummulitic limestone is again found, forming a small range of hills in the Chappar valley; dip *west*; strike N.N.E. by S.S.W.; and beyond this again, the Chappar valley extends some six or eight miles in diameter, and is bounded on the western side by ranges of mountains having the usual strike, and apparently a western dip.

Valley of Rodinjo.

This is of the same geologic character as that last described. The eastern boundary, as before stated, is formed by the Syud-Ali range, probably 1,000 feet high near its centre, composed essentially of nummulitic limestone. Dip E.S.E.; strike N.E. by N., and W. by S.

* There is no doubt about the fossil being an *Orthoceratite.*—*H. J. C.*

The western boundary, for six miles from the northern head of the valley, is formed by hills of calcareous shale and white and reddish coloured limestone, with a portion of the Siakoh, already mentioned, in the back ground.

The upper portion of the valley is, perhaps, two miles wide, but it becomes much more extensive southward. If a section was made across its *upper* end, we should find the following arrangement:—

1*st.*—Nummulitic limestone.

2*nd.*—White or light-coloured limestone, without fossils.

3*rd.*—Clays and marls. These extend (more or less apparent) across the valley.

4*th.*—Calcareous shales and white limestone, similar to those already described.

5*th.*—Sandstone. Solitary sandstone strata crop out perpendicularly, like dykes, from the valley bed to a height of eight or ten feet at intervals. Strike N.N.E. by S.S.W. Dip usually vertical, but toward the western side forming low hills, with a dip N.W., and further on S.E. In many places this sandstone contains pebbles of *grey* limestone and flint, arranged in parallel layers, and in some places to so great an extent as to become a conglomerate. I found also in one place this conglomerate immediately underlying grey limestone, which in turn underlay nummulitic limestone. In one spot, amongst the clays, the sandstone strata wore a very curious aspect ; it had evidently been altered by heat. The granular texture was lost; it had a greenish colour, blackened externally. The surface of the ground around was covered by a layer of black stone in minute pieces, apparently altered clay.

The strata were contorted and twisted in all directions, enormous fragments, which had acquired a cup-shape, lying loose on the surface. The stone emitted sparks when struck, and was excessively hard. The spot had the appearance of having been the centre of some volcanic action.

In the bed of the valley, a stratum of sandstone outcropped, saturated with common salt, which had effloresced and stood three-quarters of an inch thick on the surface of the stone.

6*th.*—The chertaceous stone (spoken of in the Kelat valley) forms low hills, black in colour [fine diorite, amygdaloidal,

zeolitic, and micaceous]. It appears to be altered siliceous clay, as further on, in the same hill, I found clay partly resembling it in structure and colour. It contains the oolitic grains of a pure white mineral [zeolite], in some cases effervescing with acid, also specks of a mineral resembling black mica [mica] in scales (*vide* specimen).

7th.—Near the last-named hills, limestone strata, vertical, containing nummulites. This limestone is not so hard as that found in the same position in the Kelat valley, and does not, I think, contain silica.*

8th.—Calcareo-argillaceous schist in laminæ, about quarter of an inch thick. Dip vertical.

9th.—And lastly, calcareous shales, white and red, varying in thickness from half-an-inch to one inch. Strata contorted, forming hills from 60 to 150 feet high. General strike N.E. by N. by S.W. by S.

Ten miles to the southward of this the nummulitic limestone of the Syud-Ali range *immediately overlies* the clays and marls, interstratified with calcareous shales and limestone; thus satisfactorily showing the relative position of these beds.

Amongst the clay hills I found springs of water impregnated with nitrate of potass, the surface of the ground around being covered with an efflorescence of the same.

The sandstones were of various colours—green, black, and red; and the marls—purple, green, red, chocolate, brown, and white.

The village of Rodinjo is situated some ten or twelve miles down the valley, and is surrounded by a considerable amount of cultivated ground.

Summary.

This great mass of mountains appears to be composed essentially of nummulitic limestone, or, at all events, that portion of it lying east of Kelat. I have not had the opportunity of examining into the character of the ranges lying westward of the 65° of east

* It is made up almost of *Orbitoides* like *O. Prattii*, but a different species if not a variety; thin, spreading and papyraceous, with here and there a minute nummulite of the group "Plicatæ vel Striatæ" d'Archiac and Haime. It corresponds closely with the Foraminiferous deposit cropping out of the clays in the valley of Kelat.—*H. J. C.*

longitude, but my impression certainly is, that as the greatest height is attained at Kelat, where we find the secondary strata exposed, so the lesser ranges, forming the westward flank of the great chain, agree in character with those observed on its eastern flank. This, however, will be matter for future investigation.

The parallelism of the ranges is extremely marked, hardly ever varied to any appreciable extent. And this has struck me more forcibly since writing the former part of this sketch. Having marched eastward, I have had the opportunity of crossing many of the hills at right angles, and of becoming more thoroughly acquainted with their structure.

Lines of disruption appear to run from east to west in several places. This is very distinctly seen to be the case in passing from Kapote to Punderan, a distance, in a straight line from west to east, of six miles. Gorges cut through five ranges in succession, and the water-drainage is almost, for that distance, due east. These gorges also form the only means by which horsemen can travel from one village to the other, the hills being otherwise impassable.

The Herbooi range is probably one of the greatest magnitude and longitudinal extent found in Sarawan. Its summit must, I think, attain a height of 9,000 or 10,000 feet above the sea.

It is composed entirely of nummulitic limestone, and its dip is uniformly east. But the Cheheltan,* as a separate mountain, is the *highest* in the country, towering more than 6,000 feet above the valley of Kanhee, which, again, is more than 5,000 feet above the sea. From its summit the line of the Bolan Pass is seen, running through the great chain towards the plains; and it is said that the plains of Kutchee may be distinguished on a clear day.

Very unfortunately I was unable to make the ascent of this mountain from sickness. I accompanied Major Green to the Fukkeer's Hill, rather more than half way, where we halted for the night, but extreme indisposition compelled me to retrace my steps on the following morning; and I was unfortunately too ill to make any observations on the botany or geology of the mountain. Major Green gained the summit, and ascertained the boiling point of water. He described the whole country around lying as a mass at his feet. The *parallel* ranges of the hills

* Forty bodies.—*Pottinger.*

distinctly traceable, and the faint outline of the pass cross-cutting in mountains intervening between him and Kutchee.

The second highest mountain is the Kohimaran, or Hill of Snakes, already described as bounding the Mungochar valley to the E.N.E. I would suppose that its actual height is not *very* greatly inferior to the Cheheltan, as its base stands several hundred feet higher than the base of that mountain, but from the valley its apparent height is much less.

It may, perhaps, be objected that the term *table-land* is not strictly applicable to that tract of country, and comparing it with the vast table-land of Northern Asia, properly so called, it may not be, perhaps, altogether deserving of the name. The reasons that induced me to apply the term were these, viz.:—It is not an unbroken chain of mountains, as are many of those of Asia and Europe, with inaccessible heights and many isolated peaks, but presents much level inhabite space on its broad extensive summit, in the shape of valleys rising in level terraces, one above the other, reached by passes from the plains below; its height not being confined to ridges or peaks, but common to the general elevation of the mass; its breadth being considerable in proportion to its height, and from the fact of its being universally habitable, and occupied to a great or less extent.

I have not spoken of the geology or botany of the Provinces, as I hope to do this in a future paper, when I shall have had a more practical knowledge of those subjects.

Note.

Since completing the above report, I have met with a passage in the "Sketch-Book of Popular Geology," by the lamented Hugh Millar, and which has been published only a few months, which rather pointedly bears on the question I had considered doubtful when speaking of the fossils of the clays, viz. whether it was possible that the fossil I have supposed to be an *Orthoceras* could have existed in the secondary period.

I quote the passage in full :—

"The next point which demands attention in our short *résumé* is, that great break between the Permian and Triassic systems, across which, as stated in the following pages, not a single *species* has found its way. Much attention has been

given to the great Hallstad, or St. Cassian beds, which lie on the northern and southern declivities of the Austrian Alps. These beds belong to the *Upper Trias*, and they contain more *genera*, common to palæozoic and newer rocks than were formerly known. There are ten genera, peculiarly triassic; ten common to older, and ten to newer strata. Among these, the most remarkable is the *Orthoceras* which *was before held* to be altogether palæozoic, but is here found associated with the ammonites and belemnites of the secondary period."

This fossil becomes, therefore, now only an additional evidence in favour of considering the clays of Kelat to belong to the secondary period, and probably holding an analogous position with the trias of Europe. The *Nautilus*, resembling *N. truncatus*, one of the distinctive fossils of the Trias, was, as I have before stated, found in these clays.*

* I have carefully examined all Dr. Cook's geological specimens and fossils, and find that they contain :—diorite, dioritic rocks, and amygdaloidal trap—diorite with zeolite and mica; cherts of kinds; and coloured clays, apparently thus altered by heat, also calcareous and argillaceous shales, and nummulitic limestone, the shales apparently not belonging to the latter series.

Among the fossils are many specimens of an *Orthoceratite* with marginal siphon; several species of *Ammonites*, but no *Ceratites* amongst them, nor any ammonite identical with those figured in Grant and Sykes' fossils from Cutch. There are also several incomplete specimens of a *Belemnite*, with nothing remarkable in its form; and the rest of the fossils belong to the nummulitic series, viz. Bivalves, Gasteropods, and large Foraminifera.

Among the latter are, besides several species common to Sind, viz. *Nummulites, Orbitoides ephippium*, &c.—one if not more species of the former and a genus of Foraminifera, which have not yet been described, but of which I hope to give full and due notice, together with that of the other Foraminifera, sent from Kelat by Dr. Cook, in some "Further Observations on the Larger Foraminifera of Sind," which I am now preparing for publication.

The anomalous position of *Orthoceratites* in clays and limestones interstratified with Foraminiferous deposits, which to me appear to belong to the Nummulitic series, requires further investigation; while the presence of *Ammonites* and *Belemnites* with the *Orthoceratites* further proves that there are deposits there older than the Eocene age. However, as *Ceratites* has been found in the Cretaceous series, perhaps *Orthoceratites* may have made a similar leap, and may here also be found in this series. But Dr. Cook is only on the threshold of his interesting researches; and, therefore, when pursued further, he will be able to clear up all this more satisfactorily by local observation than we can by distant conjecture.—*H. J. Carter.*

TOPOGRAPHICAL AND GEOLOGICAL SKETCH OF A PORTION OF THE PROVINCE OF JHALAWAN AND THE EASTERN DIVISION OF MEKRAN.

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Presented November 1860.

INTRODUCTION.

I HAVE already described the outline of the Kingdom of Beloochistan, in the foregoing "Sketch," dividing it into five great portions, as indicated by the distinctive natural peculiarities of the country; and the following one, of a portion of Jhalawan and the eastern division of Mekran, is presented in the form of a "Diary" under the impression that the *minutiæ* (usually characteristic of this form of writing) will prove useful, if not interesting, especially from the fact of a great portion of the tract traversed having been before unknown to, and unvisited by Europeans.

The general direction of our route was as follows:—Southward to Khozdar, the ancient capital of Jhalawan, and thence W.S.W. to Mushka in Mekran, returning to Kelat by a more direct N.N.E. route. Thus traversing the three sides of a triangle, we were enabled to obtain a good general idea and some interesting geological sections of the country therein included.

The time occupied on the journey was from November to April inclusive; but a large portion of this (as will be seen) was spent at Khozdar, where we were detained until certain military arrangements of His Highness the Khan were completed; but this gave me an opportunity of more particularly examining (geologically) the country around Khozdar.

The rapidity of marching with cavalry, will, I hope, be deemed sufficient excuse for the superficial character of much of

the survey of a country, which well deserves more extensive examination, and of which the prominent characteristics have hitherto been incorrectly laid down in our maps.

The mountain range of Beloochistan, is the great natural boundary of Western India, and may be described, figuratively, as composed of a vast understructure, surmounted by parallel rows of walls (represented by mountain ranges) cut through here and there by long and meandering passages.

The approaches to the eastern face of this vast barrier—the *ramps* for its ascent—have long been known as the Passes of Moolla and Bolan. Its upper surface also has been examined to a certain extent by Europeans, but, of the *descents*, the outlets on the opposite side, the sally-ports fronting the north-west, the scarp, or external face of the wall, nothing whatever has been determined,—save the passage to Nooshky, and that northward to Candahar. Were the great "Wall of China" 150 miles in breadth, its upper surface covered by a labyrinth of longitudinal walls, the passages through which were unknown, and by no means opposite each other, its summit inhabited by a different race of people, and the character of its external front a mystery, —it would present a rather apt simile of the great natural wall bounding India on the west.

Is it to be crossed at many points or few? Does its western front present any insuperable difficulties to the accession of a hostile force? Where are its weak points? Does its surface yield supplies sufficient for the support of an invading force, which might have to cross it?—are questions which at some future day may prove of importance, but which at the present time we can but imperfectly answer. Unfortunately our progress westward stopped at Mushka when we had nearly gained the western face of the mountains; yet another range of great height rose in front of us, impassable but at one point, viz. where the road leading to Punjgoor cut through it. What information our route has afforded us, will be found in the following "Diary."

Diary.

November 5th.—Left Kelat this morning, and marched to Kapote, distance 15 miles, course S.S.E. Passed down the

Kelat valley, under the Tawar mountain which overhangs the opening into its southern extremity; thence down (or rather up, for there was a gradual rise the whole way to Kapote,) a long, narrow valley bounded on the left by the Herbooi range, which we were about to cross, and on the right by a much lower one, or portions of two ranges, having a N.N.E. strike. On the right hand were two openings leading into the valley of Toke, and a second lesser valley. On the left, ran the opening into the valley of Kuttringal.

Just beneath the Tawar, we crossed the remains of a *ghor-busta;* and in the valley beyond, passed no less than ten or twelve. They are low walls formed of huge stones uncemented, built on the slope of a gentle declivity, having a scarped face towards the descent, and an inclined plane on the opposite side. They reminded me of the vine-terraces on the hills in the South of France. They were evidently used for levelling the land for the purposes of irrigation. There are many, more substantially built than these, in the valley of Toke, and are even now made use of for the purpose indicated. We also passed several structures by the roadside which I took to be *lingums,* they are circles of stones six or eight yards in diameter, with a central upright stone; the space enclosed is sometimes paved with stones, and attached to one side of the circle is an elongated one, some 15 to 20 yards in length by one in breadth, also paved.

The usual Mahomedan square praying-places, or enclosures with an opening to the east, and a large stone on the west marking the direction of Mecca, were frequent. They are found all over Beloochistan, and along the hill-route in Scinde. Many wayside graves were also met with. Before the sun had risen, the air was intensely cold, the thermometer standing at 28° fahr., and a sharp cutting southerly wind blowing. Kapote is no village, but a few wells in the bed of a dry water-course which issues from a gorge in the eastern range.—Hills on both sides composed of nummulitic limestone, with an easterly dip.

November 6th.—Last night was intensely cold, the thermometer stood at 26° at sunrise, and showed a minimum of 24° in the night. Placed on the ground, it fell at once to 13° below

freezing point. Water spilt on a table froze instantaneously. Our camp was surrounded at night by a collection of the *feræ* that inhabit these mountains, and their howlings were incessant. I could distinguish the horrible yell of the hyena, the dog-like howl of the wolf, and the peculiar cry of the jackall. Several horses got loose (for the picketting peg held badly in the shingly bed of the nullah), and they by no means added to the quiet of the night. The kit being packed and the tents struck, we started at 7 A.M., going S.E. for a short distance down the valley until we reached a ravine in the hills to the eastward. This we entered, and passed up the dry bed of a torrent for nearly a mile. A *ghorbusta* of great strength had been thrown across the mouth of the defile, but had since been carried away almost entirely by the rush of water. It appeared to have been used as a dam, and would probably have formed a tank behind it, some twenty feet deep and many yards in length and breadth. After turning and twisting in this defile for about half an hour, we arrived at a spot where the path led up the almost perpendicular face of the cliff in front of us, in a zigzag manner. The height was probably about 200 feet, the path exceedingly steep and rugged, and completed here and there by a wooden bridge across a chasm, looking very frail from below. On reaching the summit we found an extensive plain bounded by the tops of mountain ranges on each side. We now marched N. E. across this, passing the spur of a range on the right hand, and reached in three quarters of an hour, the descent on the opposite side. Here a beautiful view opened up; the path, turning southward, led in a winding manner down a deep ravine of some 600 feet. The rocks on each side were excessively rugged and broken, forming peaks and turrets. Far away to the southward, stretched a narrow valley, bounded on each side by steep ranges. Having reached the bed of the valley, we turned north, down the bed of a torrent, then east through a narrow defile, again north-east over some very difficult ground (naked and slippery boulders) in the bed of the river. Continuing *along* the ravine we emerged at last into a narrow valley bounded on all sides by towering hills. This was the halting place, called *Badra-ka-kua*, and contained a spring of water. We arrived at 9-15 A.M. The

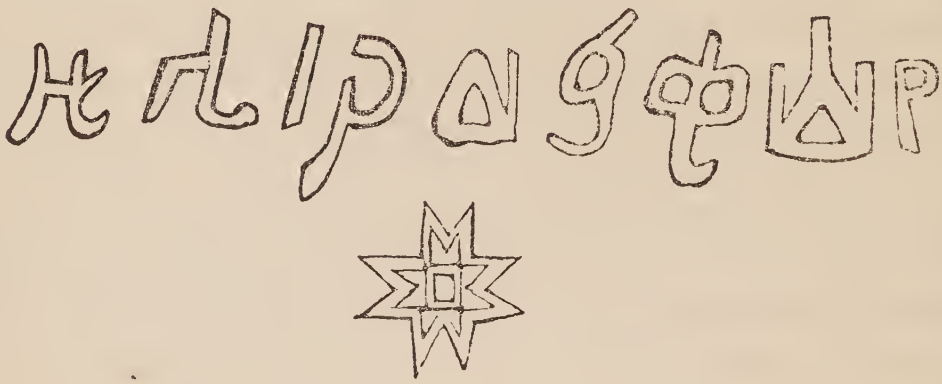
strike of the ranges passed was N.N.E., dip E.S.E., the rock composed of nummulitic limestone containing, besides nummulites, a large species of melonites (*Alveolaria*) and small bivales. A long wiry grass is found on the hills, growing in tufts, and has an aromatic flavour.

7th.—Started at 6-45 A.M., and wound down the defile in a north-easterly direction for a mile and a half. The path then turned eastward, and entered a chasm in the rock, five feet six inches only in breadth, allowing in fact just sufficient room for a mounted man or an unloaded camel to pass. The walls of the chasm rose on each side to a height of 80 or 90 feet, and the sides of mountains towered above for many hundred feet, presenting a wildness and picturesqueness that we had not before met with. The width of the chasm continued thus narrow for about twenty-five yards, and then opened out somewhat, allowing in some places two men to ride abreast. . We wound along in an easterly direction for a mile, following the bed of the torrent, and emerged on a small semicircular valley, bounded on the opposite side by a lower range (probably 1000 feet). Keeping in the bed of the watercourse, we entered a gorge in this range, and still held easterly. The nullah at places was almost filled with gigantic boulders; in some places the strata were directly vertical, and presented in consequence a most picturesque outline against the sky; but the general dip was east at various angles.

Having passed through this range, we again emerged on a valley about a mile in breadth. Here, there are two roads to Panderan; the direct one passing diagonally across the range, and a second cutting through it at right angles. Near the latter one, we were informed that there was some ancient writing on a rock, and a guide met us here, by appointment, for the purpose of showing it to us. Turning therefore N.E., and then due E., we entered a narrow gorge, similar to the preceding, and followed the bed of the watercourse, which still had an easterly direction. We then came out on a broader valley, probably three or four miles in width. Crossing this with an easterly course, we passed the ends of two short ranges with a disconnected rock standing out in the plain. On its summit were the remains of an ancient stone wall which had evidently formed

part of a robber-stronghold. The guide knew nothing of its history.

Continuing eastward, we rounded the extremity of another low range, and drew up in front of a scarped surface of rock. It was about twenty feet above the level of the valley, and on the flat surface was the following line of writing, the letters of which were about four or five inches long.



There was also the symbolical figure seen beneath closely resembling a masonic sign. The letters were not cut into the rock, but raised above its surface about $\frac{1}{8}$ of an inch. It appeared to me as if they had originally been written in bitumen or some similar substance, which adhering to the rock had preserved its surface from the eroding effect of the elements for many ages, but had eventually been removed, leaving the surface on which it had rested slightly higher than the adjacent rock, which had become worn and eaten into a honeycombed condition whilst the surfaces of the letters were perfectly smooth. We now turned S.S.E. down the valley, passing over a good deal of cultivated ground, and reached in an hour and a half a magnificent gorge in the hills, forming a narrow pass leading into a little semicircular valley in which was built the town of Panderan, distance about sixteen miles. The strike of the hills passed to-day was in the old direction, and the ranges perfectly parallel : dip E., though in certain places much disturbed.

The mountains bounding the valley of Panderan are from 1000 to 1500 feet in height. The range through which the narrow gorge passes, by which we entered, have a different dip, the strata are nearly horizontal for some distance, then rise at an

angle of 45° W., and immediately afterwards become vertical. I found the following fossils in the rock:—*Nummulites acuta*, *N. perforata* (?) a small pearly Nummulite marked with radiating lines, *Assilina*, *Operculina*, *Lycophris ephippium*, *Fasciolites*, and several Echinodermata. Univalves referrable I believe to *Conus*, *Turbinellus*, *Solarium*, and *Oliva*; and bivalves to *Cyprea*, *Cardium*, *Pecten*, and *Gryphæa*. Also several fragments of Crabs.

The bed of the little valley in which Panderan is built, is almost covered with shingle, being that of a river, along which a little rivulet now runs. At times, the torrent comes down with great force and finds its exit at the pass, leaving its highest mark some four or five feet up the sides of the gorge. During such an occasion as this, the inhabitants must be shut up in their town; but it is probable that the flood passes off very rapidly. Panderan is considered a very healthy spot, much more so than Nograma our next halting place; but from its confined position I should imagine that it would be very hot in the summer. Height above the sea 5760 feet.

November 9th.—Started at 6-45 A.M.; marched eastward out of the pass, and then south down the valley. At 8-30 passed a very high hill on the right hand. Its strata are curved round, so as to form a kind of hollow, resembling the cone of a volcano; but on one side they are vertical and smooth like the wall of a vast fives-court. The valley narrowed as we proceeded, until it became only 100 yards in breadth, and formed the bed of the watercourse. We now entered a long pass, with the scarped surfaces of the hill on each side very high. In the centre of the pass, we were shown a spot where there was writing on the rock, but it proved to be merely a rough scrawl in the Persian character. The surface of the rock had been worn perfectly smooth by the action of water; the rock was crystalline, and resembled a reddish marble. Water now appeared in pools in the bed of the river, and soon became a small stream. The path led southward, and, débouching from the hills, suddenly entered the broad valley of Nograma, which, sprinkled with villages and dotted with cultivated tracts, stretched out before us. The river runs across it, and finds its exit at the S.E. corner of the valley, eventually joining the

Moolla river at a distance of thirty-six miles in a S.E. direction: height above the sea 4,700 feet: length of the march, thirteen miles. The valley is about seven or eight miles broad and the same in length, bounded east and west by ranges having the usual strike (N.N.E.) The northern boundary is formed by a mass of hills which appear to run across from east to west, but which may only be the *ends* of ranges. To the south is a high hill, which, intervening between this and Gwutt, divides the vale of Zehree into two. It is composed of a very fine-grained, compact red and white limestone similar to that underlying the nummulitic limestone, at Kelat, and contains no fossils, but minute black specks which are perhaps silicious crusts of very minute foraminafera. It is interleaved with slabs of chert, and overlies dark blue compact limestone; the ranges to the north and west are composed of nummulitic limestone. The valley contains seven villages surrounded by trees, gardens, and cultivated ground, and watered by streams from the river beforementioned, but the uncultivated parts are sandy and stony, although it is said that at times the whole surface is covered with grass.

November 14*th*.—Marched to Gwutt in the valley of Zehree; course S.W.; distance eight miles. The valley is rather larger than that of Nograma, and contains several villages. It is about nine miles in diameter, triangular in shape, and the southern boundary is formed by hills which constitute the head of the Moolla pass. The village of Gwutt is situated close under the western range, and is surrounded by gardens, which contain a few palm trees, evidencing our approach to a warmer climate and lower level. The thermometer stood at 77° at noon, but there was a frost last night. This is the residence of Taj Mahomed, Sirdar of Jhalawan, a man of considerable intelligence and polished manner; he has lost one eye, and his face, otherwise handsome, is marked with small-pox. Another chief lives near, named Suffurkhan, a villainously bad-looking little man, with a Richard the Third's face. There is a small range of hills, an outlier from the greater range which separates the two valleys, situated a few miles from the village, which is interesting as having been used in former times as a place of retreat by the

inhabitants of the valley when attacked. It is said that the brother or sister of Siwah, the last Hindoo Chief of Kelat, fled here, and was joined by the Khan. It is a detached hill, about 100 feet in height, composed of the red and white compact limestone. It shows evident traces of having been fortified; presents a scarped face on the N. and E., and a slope towards the south. On the upper part of this slope are the remains of six or seven walls of stone, forming terraces one behind the other. The hill is covered with loose stones, the *débris* of pottery, &c. On the summit are two large reservoirs for water, cut out of the solid rock; they are about fifteen feet square, and twelve feet deep, separated from each other by a division of rock about one foot thick. One portion of the hill forms a spur, with scarped sides, running out some twenty yards, and flanking the slope before spoken of; it is surmounted by a wall, about eight feet high, formed of large blocks of stone, squared and put together with much regularity, but showing no traces of cement. The rock abounds in holes and caves. A pool of water of considerable size is observable about four or five miles distant on the plain.

16*th.*—Marched S.S.W. down the valley to Gajin, distance eight miles. The valley is a dead level; soil sandy, and lightly sprinkled with plants. It has the appearance of having been overflowed at times with water, which is probably the cause of the unhealthiness attributed to the place.

17*th.*—Started at 6-30 A. M., and reached Karruk at 10-45; distance 16 miles; course, first south down the valley, the hills on each side having a N.N.E. strike for three miles. Passed a low hill on the right composed of dark blue limestone, similar to that which underlies the red and white limestone at Kelat; the hills before us then assumed an opposite direction having a strike of W.N.N. We entered these and crossed the Moolla Pass, and saw Bappoo lying on the right about five miles off. The hills now became very much confused; some on the right continuing the N.N.E. strike: dip at times distinguishable E.S.E. We crossed some rugged ground, passed up a narrow valley, which had six or seven ghorbustas running across it. Then up a water-course into a second narrow valley, very rough and covered with stones, also crossed by ghorbustas much higher and larger than usual.

A smaller valley branched out of it, and here there were several of these structures eight or nine feet in height, built of very large blocks of stone, and bearing traces of great age. Near the line of road were several *lingums*, similar to those before described, and also the usual Mahomedan praying-places. Further on, we passed many more ghorbustas built across ravines. We now crossed a range of coloured limestone, shales, and argillaceous shales, almost resembling slate in some places, in others softer and friable. The dip was westerly; but from the broken-up character of the country, I could not ascertain the relative position of these strata with regard to those already past. The path now led east through rugged valleys, the hills running nearly east and west; dip south. At 10 A.M., opened out into a long valley running N.N.W.: turning east up the valley, we halted in the bed of a broad nullah, in which there were a few pools and wells of water. We passed, before entering the valley, a spot where, on a gentle declivity, were ten ghorbustas at intervals of twenty yards, presenting as usual a scarped face to the declivity, and a talus on the opposite side. For the first time since leaving Kelat we met with the *jow* plant, so common in Sind. The oleander is also plentiful. The nullahs are bordered, and at times nearly filled with a bush bearing small blue, labiate flowers in spikes; the leaf is palmate, and has a powerful odour exactly resembling that of the black currant leaf. It is called *somalu* by the Brahooees. There is also another plentiful shrub bearing an orange-yellow berry which is said to be extremely poisonous.

November 18*th*.—Started at 6-20 A.M., going at first east, until we reached a gorge in the range, through which we passed into another valley. The path now led through a most broken tract of country for several miles, along narrow valleys cut up by nullahs and bordered by low hills, thrown about in every direction. The displacement of strata very great. The hills formed of the red and white limestone, which at places became very argillaceous and passed into a shale. In one place, we passed under a hill, 60 feet high, rising from the bed of the valley, which had evidently been (comparatively) recently up-raised. Its summit was topped by a layer (unconformable) of recent

conglomerate, of exactly the same character as that lying in a nullah at the base of the hill, and of the same date.* I failed, however, to detect in any place the intrusive rock, nor were there any fragments of trap-rock to be found. The surfaces of the thin, shaly strata had evidently been very little weather-worn, for the angles were as sharp as if recently fractured. At 8-15 passed a nullah containing water. This is an occasional halting place, and is named Dewane; near it were several *lingums* and ghorbustas, with the Mahomedan praying-places. We now passed south and southwest-ward; the country as we proceeded showing less and less of the evidences of the disruptive force which had exerted such a power in the spot just traversed. At 10 A. M. passed through low broken hills, of shaly and marly limestone, near which, though not in contact, was an out-cropping of the *chert* seen in Rodinjo valley, showing the propinquity of the intruding rocks: here we startled four *gud* (wild mountain sheep). The ranges now assumed a more north and south strike, losing the east and west direction of those bordering the Moolla Pass. At 11-30 saw the village of Nogai,—distant about three miles on the right hand,—and at 11-45 halted in the bed of a water-course, which was nearly covered with a thick jungle of the *somalu* shrub; here there was a plentiful supply of water in pools, and the place is frequented by wild duck; distance nineteen miles: baggage not up until evening. The hills on each side the halting place are low ranges having a N. and S. strike. That on the right hand was composed of the red and white limestone; strata vertical: that on the left presented some curious appearances. It was essentially composed of the red and white shaly limestone, but cropping out of it, as it were, and projecting many feet above it, was a *massive*, excessively hard, sub-crystalline rock; its surface was mottled, and had the appearance of conglomerate in the distance, but, on close inspection, it was found to be composed of rounded masses of dark bluish limestone, imbedded in a lighter coloured arenaceous matrix: both contained nummulitic fossils, resembling those found in the massive strata cropping out of the red and white shaly limestone at Kelat (not true nummulites). Huge blocks of this rock, fifteen feet square, lay heaped on each other on the

hill, and masses had rolled down its sides. The strata were vertical: the massive rock had all the appearance of having been protruded like a trap-rock through the shales, and in places had greatly displaced them. At one spot there was a kind of fault, and the strata were twisted round at *right angles* to the ordinary strike; but I think this crushed and twisted appearance of the shales might have arisen from the very different character of the two rocks. Supposing the nummulitic massive limestone to have been deposited conformably on the shaly limestone, and afterwards upraised and inverted, its greatly superior weight and utterly unyielding nature would, in the *mêlée*, have crushed the adjacent thinner strata into the condition in which I found them. To the eastward of this arose a second range of the same strike and dip, composed of the red and white limestone; and beyond it a mountain, about 1,000 feet high, of the same rock.

19*th*.—Marched to Baghwana, distance four miles; direction south-east. Passed a low hill on the right hand, of which I obtained a fragment, but unfortunately could not give it the attention which I afterwards, on examining the specimen, found it deserved. It was a bluish red, compact, massive rock, containing much siliceous matter, traces of small fossils not distinguishable, and casts of *belemnites* in siliceous matter. The rock therefore evidently belonged to the secondary period, and its connection with the surrounding rocks would have been important information.

The valley of Baghwana runs E.N.E. by W.S.W.; the ranges bounding it having apparently an approximate strike. But that on the south is made up of a series of ranges having the N.N.E. strike, the northern extremities of which form the boundary in one continuous line. Cutting through this for a considerable distance, near the S.W. corner of the valley, is a remarkable gorge. The mountain is 1,000 feet high, or perhaps more, and is split from top to bottom by this gorge, the sides of which are perpendicular, its breadth about 100 yards at the entrance. It continues about this breadth for half a mile, when it widens out, turns suddenly westward, and again narrows. A stream of water runs through it from N. to S., or from the valley of Baghwana into the gorge. In the centre of this ravine is a little

village called Gharra Ghur, surrounded by cultivated land. Like many other spots in the bosom of the mountains, its existence would never be guessed by a person not thoroughly acquainted with the country. A foot-path through the hills passes this way to Khozdar. The mountain was made up of the red and white limestone with the flint (or cherty) slabs, and to so great an extent do they exist here that I should think they made up one-sixth of the whole thickness of the beds. The deeper strata were more argillaceous, shaly and coloured purple, reddish brown, &c.; dip N.W. About a mile from this spot further eastward, I came upon a more superficial section; and overlying the red and white limestone, I found a thick massive stratum of the siliceous, nummulitic limestone resembling that at the last halting-place. At Kelat (and as we shall afterwards see at Khozdar), this is conformable with the underlying rock. On examining the ranges bounding the valley, westward, I found them to be composed of the same red and white limestone with chert slabs. The valley is extensive and contains several villages. It is watered at its western end by a stream that rises from a fountain in the rock about a mile distant. There are several large gardens at this end, filled with fruit trees, above which many tall palms (date) rear their heads and give an oriental appearance to the scene.

Two mounds exist in the valley; one is large and oblong, and projects some ten or twelve feet above the level of the ground; the other is round and higher, and is the remains of a tower, which had been built of burnt brick. Amongst the low hills on the south-west of the valley is a hole or slit in the limestone rock in which the bodies of babies are found. On visiting it, I found it to be long and narrow, and not more than six or eight inches deep. It passed back into the rock for some yards, and its mouth was blocked up with large stones. On withdrawing these, I found several bones, (upper arm and thigh) of infants, a portion of a foot and hand, and large quantities of rotten coloured clothes similar to those worn as loongies by Brahooees of the present day; and on searching further, pulled out the remains of an infant, which had apparently reached the age of two months; it was perfectly dried and mummy-like, and weighed but a few ounces; the

eyes were gone, and the liniaments not distinguishable ; the hands were crossed on the chest, and tied in this position by a piece of cotton cloth ; it emitted no odour, and had evidently been perfectly dry for a long period. Further back in the cave, I distinguished two bodies of others; but it was too dark to ascertain how many the cave contained ; and, replacing the stones, I withdrew. Fragments of coloured cotton clothes lay on the ground around, having probably been extracted by foxes in search of the bodies. The people say that the hill-women, used to bring their babies and place them in the cave, but how long ago, or for what purpose, I could not ascertain. It was probably a Hindoo custom derived from some Rajput Tribe that had settled in Jhalawan, and had been incorporated with the Brahooees.

22nd.—Marched to Sekran, distance twelve miles. We first struck S.S.W. across the end of the valley and entered the hills, which were composed of the red and white limestone with flints; the strata dipped in various directions, and the strike was confused. Crossed the spur of a low hill, and, after winding through watercourses for some time, entered a narrow valley running north and south. We here saw a number of the largest ghorbustas that we had yet met with. The valley sloped to the north, a broad and deep nullah finding its exit at the northern end. Projecting from the face of the rock, bounding the narrow gorge on the left hand, were the remains of a very thick and strong stone wall that had evidently, at one time, extended across the gorge, damming up the watercourse ; it had been carried away by the force of the current, consequent on the breaking up of the walls on the higher ground. Twenty yards further on were the remains of an enormous ghorbusta, extending quite across this end of the valley ; it presented, as usual in all well-preserved specimens, a scarped face to the declivity, and a talus on the opposite side, and had evidently been strengthened by a broad, earthern embankment which had been kept in position by low walls extending at *right angles* from the dam; the scarped face was about twelve feet in height, and the stones of which it was composed very large and massive. About thirty yards behind it, was another, of much the same construction, but not so massive, as the ground had not so great a slope. After this

came a third and a fourth, of still less size and strength, all these had been broken through, in many places, by the force of water, which had entirely carried away the lowest one originally extending across the gorge. On the western side of the valley, which had a slope towards the centre, were a number of low ghorbustas placed one behind the other, they were only raised about a foot or eighteen inches above the level. In the valley, which now widened out until it became a mile and a half in breadth, were several longitudinal mounds of earth, and at its southern end, a low flat stratum of rock projected about two feet from the ground, in the centre of which was an oblong excavation about two feet in depth, which resembled in form a Mahomedan mosque.

We now passed to the S.W. up a deep nullah, through a broken range of hills of the same limestone. Across the nullah, extended the remains of several ghorbustas, portions only remaining on isolated mounds and rocks in the centre of the nullah. We now emerged on the long valley of Kuppar running N.N.E. by S.S.W. The range bounding it on the west was high, tortuous, and broken, and had a W. dip. In many places, the strata were greatly contorted and twisted, apparently by lateral pressure. On our left hand, we passed some low hills projecting from the plain, composed of the dark blue compact limestone, seamed with carbonate of lime, and containing faint traces of fossils—the same rock which underlies the red and white limestone at Gwutt and Kelat. After traversing the length of the valley, we halted at a beautiful spring of water near its southern extremity. The southern boundary of the valley is formed by a range having nearly an east and west strike, which separates it from the valley of Ferozeabad: there is a gorge here, and through it the little stream loses itself in the valley beyond. The ground around the water was thickly covered with a low jungle of an aloe-like plant, with fan-shaped leaves, which the natives call *peesh*; this was the first time we met with it. The range bounding the valley to the right, composed of dark blue limestone, here bore off more westerly, and from the angle projected a low hill, formed of a purplish, subcrystalline rock containing ochres, whose surface was covered with a thin layer of some black mineral.

I afterwards heard that the men of our escort had found pieces of stone near this hill containing small masses of pure native lead. The hills on the opposite side of the valley wore the same appearance; in many places the surface was perfectly black. As soon as our horses came up, we mounted and rode to the mines, for which Sekran is celebrated. We first passed northward up the valley, and then, turning westward through a gorge in the hills, ascended a rugged nullah; and in half an hour found ourselves in a narrow semicircular valley surrounded by high hills. The strata dipped east; the hill on the westward was composed of the dark blue limestone; that on the east, in which were situated the mines, wearing a blackened and cinder aspect. Vast quantities of black metallic-looking *débris* covered the base of the hill, in whose sides here and there, at various elevations, were observed the low cavern-like mouths of the many mines which riddled it. Taking with us candles, rope, and lamp, we ascended this vast mass of slag-like looking stones, and climbing the sides of the hill about 150 feet, reached the mouth of a mine. The rock resembled an altered claystone, variously mottled, black, purple, and metallic grey; veined, and dotted red and white, and containing small cavities filled with bright red and yellow ochres, and the fracture of some specimens showed a metallic appearance of steel grey. The stone was heavy and massive; some parts of it effervesced with acid; it was stratified,—the strata dipping east; and the upper strata were composed of the dark blue limestone. Near the mouths of the excavations were small masses of granite, which had apparently been brought up from the bowels of the mine. The gallery ran downwards at a steep inclination following the dip of the strata. We passed down some distance on our hands and knees, but finding it almost blocked up with earth, rock, &c., and the air very unpleasantly close, we did not carry on its exploration; but, going along the side of the hill some two hundred yards, came to the opening of a mine which had on a former occasion been entered by Major Green. Here we lit our candles and crawled downwards on hands and knees along the narrow passage. Fragments of bones lay about evidencing the occupation of the excavations by wild animals. After proceeding for some time

in this constrained position, we came to a spot where there was a sudden drop of some six or eight feet like a well. Descending this, we found a hole at the bottom leading horizontally inwards. Through this we struggled, and along a narrow gallery, whose roof was so low, that it obliged us in some places to lie flat. We then emerged into a wide space, and sufficiently high to allow of one sitting up. From this branched several low galleries: selecting one, we crawled along some yards, and found another well-like gallery penetrating at a considerable angle downwards. It was so choked up that we could not force a passage, but proceeding along the horizontal gallery, we reached its extremity. Here were many bones of oxen, camels, &c., and the excrement of the hyæna,—not a pleasant fellow to meet in these narrow passages, coward as he is. The surface of the walls and roof was spangled with glistening crystals of sulphuret of lead, and coloured with ochres: bright, white, needle-shaped crystals also sparkled on every side. The rock is rather easily worked, and I hammered away a good portion of it. Retreating now, as the atmosphere was becoming very oppressive, we reached the central excavation, and, taking another gallery, soon discovered daylight at its further end. There were many other excavations in all directions in the side of the hill, some large enough to admit a man in the erect posture, but these only extended a short distance; others were so narrow and choked with *débris* that we could find no means of entrance. The mines have evidently been most extensively worked at some remote period, but the Brahooees have too great a dread of the supernatural beings who, they believe, inhabit them, to allow them to enter: they content themselves with breaking off portions of the rock from the hill sides and extracting the lead and antimony as required. There is a peculiar tribe called Merdooe, who reside some few miles distant, who more especially work at this.

23rd.—Marched to Khozdar, fifteen miles; passed eastward for four miles, then crossed a low range of hills into a little valley, containing the village of Kuppar; it is well cultivated and watered. The ranges passed were broken and confused; the first composed of the dark blue limestone, others of the red and white shaly limestone, whilst the spur crossed was made up of

a metamorphosed clay-stone. We now passed E.S.E. along a nullah, the hills on each side having a like strike, the dip occasionally vertical. Saw recent conglomerate and gravel, forming a bed twenty feet above the present level of the watercourse resting on unconformably upturned, coloured shales, the road very rugged for some miles. On the left hand was a hill of peculiar aspect, pyramidal shaped, with a square mass on the top, formed by the unequal wearing away of horizontal strata.

We now entered the valley of Khozdar and passed E. N. E. up it until reaching our encamping ground, near some pools of water surrounded by palm trees,—the village in the background. The valley of Khozdar is extensive, in shape somewhat like a Maltese cross, and through it, from north to south, passes the caravan road to Wudd and Beyla. The upper portion of the cross runs northward some five or six miles, until it is closed in by parallel ranges, and the southern portion passes south towards Wudd, while the eastern, in which is situated Zeedee, stretches away some twelve, fifteen, or eighteen miles, and the western limb joins the valley of Ferozeabad. The ranges bounding it have, as a rule, the N. N. E. by S. S. W. strike, but those of the valley running towards Ferozeabad have an E. and W. strike. Those bounding the northern spur of the valley are perhaps the highest, and the most elevated of these is called the Hulwaee; I should suppose it to have a height of 3,000 feet. Opposite it, is a lower hill called Siah-sir; south of this rises the Siah, bounded in front by a range called Kaman Farosh, and westward by a hill called Pubb. The village of Khozdar is small, containing, perhaps, 200 houses, and half a dozen buniahs' shops; it is surrounded by date palms, and a river issues from the hills at the northern head of the valley, probably the one we left at Baghwana, running south *into* the hills; this takes a southerly course, and is joined by one which rises at Sekran; then flows on east, past Zeedee, and then turns south, when it is joined by a second, running up from the south-east; it now enters the hills flowing south, and probably gains the plains of Sind at the "gorge" near Sehwan. Its bank and certain portions of its bed are covered by high flags and reeds, in which the wild hog is occasionally found, and the land bordering it is

well cultivated, but a large portion of the valley is sterile, stony, and cut up by ravines. There are one or two mounds in the valley from which have been obtained bits of copper, glass beads, cornelian ornaments, old coins, &c., and there is a mound near the town surmounted by masonry. As Khozdar was formerly the capital of Jhalawan, this might have been the residence of the chief. About a mile distant are some low hills called Mullik Chup, and in a narrow valley between, a vast number of graves covering the victims of Mahmood Khan's treachery, who invited sundry of his chiefs and their followers to dine there, and massacred them to a man. Wild duck and geese frequent the river; partridges are found in great numbers near the cultivated ground; deer roam over the stony tracts, and the neighbouring mountains contain the gud (wild sheep) and ibex. A section of the range (Hulwaee) bounding the valley on the N. E. gave as follows, from above downwards:—

1*st.*—Bluish grey limestone, dotted with minute black specs; —20 feet and no fossils.

2*nd.*—Hard subcrystalline siliceous nummulitic limestone, resembling that seen at Baghwana; stratum massive, undivided, and thick; nummulites small, and the rock so hard that they cannot be easily made out. I think I also distinguished *operculina, orbitolites,* and *alveolina:* thickness,—8 feet.

3*rd.*—A purple coloured limestone spotted with yellow argillaceous spots; no fossils,—10 to 15 feet.

4*th.*—Reddish or chocolate-coloured, argillaceous limestone, showing a tendency to split up into spindle-shaped fragments, —40 feet.

5*th.*—A second stratum of nummulitic limestone resembling the first, passing downwards into a dark subcrystalline limestone, with no visible fossils. These five strata formed a low hill that lay along the flank of the range; their inner and lowest strata overlay conformably, the strata forming the mass of the mountain, which was made up of,

6*th.*—Red and white limestone with slabs of chert.

An enormous cleft or gorge, runs some 400 yards into the side of the mountain, and is about 40 or 50 yards broad, terminating in a *cul de sac* at the end. It gave an excellent section of

great depth. The red and white limestone passed into a bluish compact limestone, this into a dark subcrystalline rock, and lastly into a purple, shaly limestone variegated with yellowish stains. The entire thickness of these strata must have amounted to 1000 feet, yet they retained the same fine-grained compact character throughout, and I could find no trace of any fossil. The dip on this side the mountain is west, but the strata on the opposite side dip in the opposite direction, and thus show a well-defined anticlinal axis.* The mountain behind it has a similar conformation. Very deep ravines cut up the base of the mountain and run out into the valley, showing that the bed of the valley for some four or five miles is formed of a talus of the *débris* from the mountain sides. These narrow and deep ravines are inhabited by Brahooee families whose presence is totally unseen and unsuspected until suddenly come upon in this manner.

The following is a section of the "Siah-sir" mountain. As will be seen, it closely resembles the former.

1*st.*—Red and chocolate coloured limestone with yellowish green spots and streaks, greatly divided by cross splits with spindle shaped fragments, the surface of which has a tendency to scale off, leaving rounded extremities,—30 to 40 feet.

2*nd.*—Siliceous, nummulitic limestone in a single massive stratum,—6 feet.

3*rd.*—Bluish coloured compact limestone,—4 or 5 feet.

4*th.*—Purple, shaly, argillaceous limestone, several of the strata greatly divided,—12 to 15 feet.

5*th.*—Sandstone, varying in character, fine grained with but little calcareous cement and a coarser, saccharoid kind, freely effervescing with dilute acid; also a dark, fine-grained compact sandstone, which had acquired externally a jet black hue, and high polish, and which, projecting from the other strata, formed a well marked stratum on the side of the mountain,—20 feet.

6*th.*—Fine-grained, compact, white limestone with flint slabs, —800 feet or more.

* This is a very frequent form of the mountains about Khozdar, viz. the dip in two directions, or sometimes three, with an anticlinal axis. Khozdar appears to be the focus where the ranges from the North stop, and those from the South commence.

The first stratum of nummulitic limestone is here wanting, and the dip of this part of the hill was south, but on examining the range further north, I found the omission filled up, and the series as follows :—

1*st.*—Light coloured, bluish limestone ;—20 to 30 feet.

2*nd.*—Massive, subcrystalline nummulitic limestone,—10 feet, in one stratum.

3*rd.*—Purple and red argillaceous limestone, with yellow spots, split up into spindle-shaped fragments,—40 feet.

4*th.*—Second stratum of massive nummulitic limestone,—10 to 12 feet.

This stratum in some places merged into argillaceous limestone more or less sparsedly dotted with nummulitic fossils, until it became purely an argillaceous, red limestone, in some places shaly.

5*th.*—Dark, subcrystalline limestone,—a few feet.

6*th.*—Sandstone, white and crystalline internally, black and shining externally,—8 or 10 feet.

7*th.*—Light coloured, compact limestone with flint,—1000 feet.

A section of the hill lying opposite to this, towards the south, gave a very similar series, but the first stratum of nummulitic limestone differed in being less compact and massive and more arenaceous.

The low range of hills lying in front of the Siah mountains, is called Khaman Farosh, and has a strike south of camp nearly east and west. It is made up of the red and white compact limestone with flint or chert slabs. Flanking it, is a low range, the strata of which are much twisted, showing two waves of elevation with a broken scarp to the valley. This section gave :—

1*st.*—Grey speckled limestone.

2*nd.*—Purple, shaly limestone, interstratified with a light coloured marl,—no fossils.

3*rd.*—Dark grey limestone,—no fossils.

4*th.*—Nummulitic limestone, arenaceous; many of the nummulites are large and loose; I found also an *assilina*, and a *lycophris*.

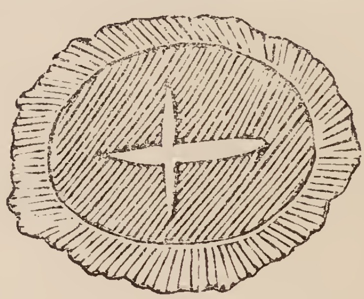
5th.—Purple, more or less shaly strata.

6th.—Second nummulitic stratum, passing downward into a crystalline limestone.

7th.—Sandstone,—no fossils.

8th.—Compact limestone of the hill range,—no fossils.

A gorge passes through this range, which, winding among low hills, leads back to the Siah Mountain. On entering it, the range on the right hand had a strike of N. S. W., and dip of N. N. W.; in some places the strata were nearly vertical, and were all raised at a considerable angle. The compact limestone with flints passed downwards into coloured argillaceous, shaly limestone. The path led along deep ravines over the upturned edges of these strata, in a W. S. W. direction. In an hour, I reached a spot where the shaly limestone contained a vast number of large, oval concretionary masses embedded in it. In some cases veins of carbonate of lime passed continuously from the limestone through these masses, plainly showing that they were not foreign rolled masses. The limestone everywhere showed traces of *iron ;* cavities in it were filled with ochre, and thick veins of iron ore were frequent. Further on, the surface of the strata was covered with spherical masses from the size of a bullet to that of a cannon ball. On a blow from the hammer they easily fractured, and presented the following appearance (*vide* sketch). An exterior layer of crystals of some



salt of lime, then a mass of greyish subcrystalline rock with a central star-like nucleus of crystallized carbonate of lime. I could find no enclosed portion of shell or any animal or vegetable organism which could have formed a nidus. On continuing the search in this locality I found an *ammonite,* resembling in form one of those found in the orthoceratite strata at Kelat. I could, however, find no trace of any belemnite or orthoceratite.

On continuing the examination, I found the shaly limestone strata were continued back, forming two or more ranges until they abutted on the Siah mountains. From this, they were separated by a broad ravine; but I think there is little doubt that

their strata conformably overlie the dark-blue, compact limestone of the Siah. This mountain has a height of 2,000 feet. Its sides are cut up by tremendous ravines clothed with wood. From its summit a magnificent view of the whole surrounding country is obtained. It is composed throughout of the dark blue limestone, patched here and there with an orange-coloured layer containing minute fossils.

The blue limestone shows traces of minute univalves and bivalves, but I could not make out distinctly what they were. The rock is, I believe, identical with that forming the Siakoh at Kelat, which also underlies the red and white limestone with flints. In the bed of the river which comes down from Sekran and joins the other river about a mile south of camp, I found the following boulders :—

1*st.*—Granite, similar to that seen near the Sekran mines.

2*nd.*—A porphyritic rock with large, separate crystals of felspar in a greenish hornblende. I quite failed to discover from whence these masses came, but their *locale* could not be very far distant, probably from the mass of hills beyond (west of) Sekran.

3*rd.*—Dark purplish, variegated rock from the Sekran hills.

4*th.*—Masses, less waterworn, of the dark blue limestone, fragments of the compact limestone of the hills, of the siliceous nummulitic limestone, and of the sandstone of adjacent hills. Also fragments of a black substance resembling obsidian, but which is, I believe, a slag formed in smelting lead-ore.

The Merdooees, a tribe of Brahooees, who reside in the neighbourhood, obtain lead-ore from many spots in their vicinity and reduce it. I visited a place called Semán, about 14 miles distant in a southerly direction. It was situated amongst low sandstone hills, black externally, resembling that described; fragments and boulders of dark blue limestone, grey limestone, and arenaceous nummulitic rock lay scattered around. Beneath the sandstone was a red, sandy clay, and in this the ore is found. My guide soon extracted a number of pieces of red ore—carbonate of lead—in thin, flat, tabular masses, looking like a broken-up vein, which were covered externally with a layer of calcareous earth that prevented them from being easily detected. The place

where this is found can hardly be called "mines," as the shepherds merely poke about with a stick, pick up any promising pieces, roughly estimate the specific gravity by the hand, and if they have not the proper weight reject them.

Some of this tribe smelted a quantity of ore for us at Khozdar; their implements were very rude, and their mode of smelting very simple. They first built a rough furnace with four upright square stones, leaving a hole below to insert the nozzle of a pair of bellows. The bellows is a leather bag, formed of the skin of some small animal, having an opening posteriorly, to which are attached two sticks which serve to open and shut the aperture. The floor of the furnace is formed of clay. On this a fire is lighted, and a heap of charcoal kindled; when at a white heat, three or four handfuls of ore are thrown on, and then covered up with a thick layer of charcoal. The whole is kept at a white heat for some time. A stone of the furnace is then pulled away, and the dross, ashes, &c. raked off from the melted metal. Fresh charcoal is then thrown in, with more ore, and again charcoal, until the furnace is full, when the fire is kept up until the fresh supply of ore is reduced, and the operation continued until sufficient metal has been obtained. This mode of extracting the metal has been carried on for ages. The peculiar slag produced is met with all over this part of the country, and oftentimes in the most unlikely places. Vast quantities of it lie near the bank of the river south of camp,—many cartloads I should think of large angular pieces, some of them weighing several pounds. I have met with it on the tops of hills, in deep ravines, and scattered over the plains, and in the bank of the river, buried from three to five feet below the present level of the surface. Under these circumstances, it has acquired an opalescent appearance. Whilst at Khozdar we experienced the bitterness of a Beloochistan winter; the thermometer fell many degrees below freezing point; severe frosts took place nightly, succeeded by intensely cold winds and heavy rain,—the mountains being covered with snow. However, as there was a plentiful supply of firewood, and the camp was placed in a dry position, our men had excellent health. Height above the sea 3,300 feet.

February 25th.—Marched this morning to Ferozeabad;—dis-

tance eight miles; direction nearly due west. There is *no village* here, although the place is marked in capital letters in the map, but about a dozen mud huts are scattered through the valley, near small tracts of cultivated land. The wheat is now springing, but as this is *kushkawah* land, the crops are very uncertain. On the road, we passed, on the right hand, first the Siah-sir mountain; dip E. and W.; then two parallel ridges, dip W., of the red and white limestone, followed by two ranges, having an easterly dip, of blue limestone; these then trended away west towards Sekran, and obtained a southerly dip. On the left hand, the Kaman Farosh, dip N. of the same red and white limestone banded with flint. Then the Pubb Mountain with the strata semicircularly curved; dip north. On the arrival of the kit, I started for Sekran to pay another visit to the mines, and succeeded in reaching the bottom of the one near the mouth of which I had seen the granite lying, on our last visit to this place; but I was disappointed in not finding the spot from which the granite had been taken. I searched minutely every portion of the interior, but the walls were entirely composed of what I have termed metamorphosed clay stone. I then climbed the hill, and found a large entrance leading into a kind of chamber where cattle had recently been kept,—the back part of it was blocked up with brushwood. On removing this, I found two passages, one leading vertically upwards to another excavation, and the other downwards. Lighting the candles, I descended some yards on hands and knees, and found myself in a large chamber with vaulted roof, capable of holding a dozen men. Leading out of it were two passages; one passed about fifteen yards into the rock and then ceased abruptly; the other was nearly closed with *débris* and descended at a considerable angle;—I was obliged to lie perfectly flat and creep along it. After passing some distance in a tortuous manner, it turned to the right, apparently crossing behind the other passage, but I thought it hardly advisable to go further, as the passage was so narrow that I could not turn, and I was obliged to "back out," my feet being considerably higher than my head, and the atmosphere from the burning candles and my own hurried breathing was becoming very oppressive. These passages must have been greatly deeper at one time, and were

probably ventilated by shafts which are now stopped up; as no human being could work in them in their present condition; they probably led into larger vaults where several men could work at a time, and through them the ore was carried out.

I think it probable from the enormous quantity of *débris* lying near the base of the hill, that, on bringing the ore into the air, only such pieces as looked promising were picked out, such as sulphuret or carbonate of lead and antimony, and the rest pitched down the hill, to accumulate in the enormous mass that now lies there.

At the base of the hill, the strata consisted of the blue limestone with patches of orange-coloured stone. Then came a thickness of 80 or 100 feet of the metamorphosed rock, followed by several hundred feet covered up by *débris;* again above this the metamorphosed rock overlaid by strata of the dark blue limestone. The whole tilted at an angle of 40° eastward; height of the hill about 500 feet. The strata of the hill opposite, consisting of dark blue limestone were very much contorted, twisted, and displaced. Near the mines, I passed a spot thickly covered with a layer of the black, glassy slag observed at Khozdar.

27*th.*—Started at 6-30 A.M., and marched in a southwesterly direction across the valley towards the opposite low range of hills, and as we neared it, its curious structure became evident. Its strike is about N. by E. and S. by W., and it is composed of an assemblage of isolated hills of no great height, interspersed with mounds of black, purple, green, bright red, and white decomposing trap rock. The trap appeared to be principally a dark brownish purple serpentine with diallage. It had greatly decomposed, breaking up into minute pieces which gave the mounds a rounded contour. I also found masses of light greenish diorite, low hills of a red rock not effervescing with acid, metamorphosed clay-stone, and a white porcellaneous stone (clinkstone?). In one spot an enormous mass of clear white marble reared its head in contrast with the surrounding colours, but I could not make out its stratification. At 9-30 A.M. we reached a spot in the centre of this range called Samunder-ka-pani, but finding a deficiency of water we resumed our march for Nal, where we arrived at 12-30 P.M.

After leaving the broken range, we emerged on the broad and extensive valley of Nal, crossing it in a W.S.W. direction.

Nal is situated on its western side near a range of hills which bounds the valley. The town is a small cluster of houses, overtopped by a square fort. It is the head quarters of the Bezonjow tribe. The valley stretches away south as far as the eye can reach, and is bounded northward by a range which *appears* to run nearly east and west, but which appearance might be caused by the *ends* of ranges having the old strike. There is a good deal of cultivation, with a large supply of camel fodder, belts of trees and jungle are visible towards the south. On the S. W. is a high mountain called Shah Sahán. Its northern extremity is separated from the ranges west of Nal by an open space, through which the dried bed of a broad river densely covered with jow jungle winds eastward. A very disagreeable dust-storm blew all the afternoon ;—kit not up until evening.

The hill behind the town is principally made up of trap-rock, capped by limestone. This limestone, in some places, is crystalline, and contains no fossils, but in others is almost *made up* of a large, flat, thin fossil with an abruptly prominent centre, closely resembling *lycophris, dispansus.*

Its surface is covered with small tubercles (but they are not I think united by stellate lines). This fossil measured $2\frac{1}{2}$ inches in diameter, $\frac{1}{20}$ inch thick, and $\frac{2}{10}$ in the centre. Mixed with a smaller and thinner fossil, it entirely composed whole strata of the rock, which thus had a thoroughly foliated appearance. I also found a fragment of an echinoderm and a portion of a large univalve. Some of the upper limestone strata contained much *coral,* but no foraminifera.

The strata were a good deal displaced. Owing to the sides of the Hill being covered with detritus, loose stones, and gravel, I could not find the junction of the trap and limestone.

The trap rock differed much in different places. In one spot being composed of serpentine, and in another of diorite, which at times became porphyritic. Again, the rock assumed a light green colour and great hardness, and had a somewhat porcellaneous fracture. In some places, the serpentine became earthy of a

dark purple colour, mottled with red and green, and veined with *carbonate of copper*, which in some cases, formed an impure earthy malachite. On coming down the hill, I stumbled over a striped hyena; but, as I was unarmed, he made off unhurt.

March 1st.—Marched to Taigab, 8 miles; direction nearly due west. The route first crossed through the range by a narrow winding pass, then emerged on a valley covered with jow jungle, crossing a very wide watercourse running S.E.; water existed here and there in pools; saw the fresh tracks of deer. We then came on the Taigab river, flowing westward; its banks covered with high reeds and thick underwood. Halted on the opposite bank, where there was a clear space in the jungle, near a low and broken range of hills; a small patch of cultivation lies on the opposite side of the river, where also there are a few huts. A vast mass of dark purple trap-rock rises from the ground near the river bank, forming a very conspicuous object against the background of light green jow jungle. The low hills near are formed of metamorphosed clay, and of marlstone of various colours stratified; they were all covered *to their tops* with rounded water-worn pebbles of blue limestone and nummulitic limestone. In one place, a rock outcropped resembling syenite, being composed of hornblende and quartz. Height above the sea, 3,600 feet.

2nd.—Marched to Greisher, 13 miles; general direction south-west. Crossing the river, we passed through a thick jow jungle for some miles, and then came out on the open valley, here perfectly flat and sandy. The Shah Sehan mountain lay on our left, and the valley was bounded on the right by a range running N.N.E. at a distance of about twelve miles. This range was low, and exhibited many colours. Dark purple trap rock, and a bright white mass here and there diversified the usual brown colour of the limestone. It probably had a similar composition to the Nal range: dip west.

We came on an encampment of Brahooees, very picturesquely situated in a glade of the jungle and surrounded by their donkeys, cattle, and sheep. The tents are composed of a dark woollen material stretched ever a semicircular framework, and the whole looked exceedingly like a gipsy encampment in an English wood. There were patches of cultivation here and there

throughout the valley, and in one spot the ground was as level as a billiard board and of much the same colour, being thickly covered with a little wild succulent plant having a flavour of mustard oil. This plant must have covered many square miles of ground: cattle would not touch it.

In the centre of the valley, about two miles distant from the line of march, was a fort, built on a mound raised about twenty feet above the level of the ground. It was uninhabited, and falling into decay. Near it was a well containing water, and close by, a dozen graves. Under the high range eastward was another fort similar to the last, which appeared to be also uninhabited.

These forts belong to the Chiefs of the Sagetees, a tribe which numbers about 700 men, and who are evidently a portion of the force that came down from the north with Alexander. The chief family of the tribe are Sakees, distinctly of Scythian origin. (The Sakæ still exist on the borders of the Caspian.)

There is no village at Greisher, and but a small supply of water in two wells. In one of these it is bad, and the other is eighty feet deep. There is some cultivated kushkawah land near, but the country is very thinly inhabited from the want of water.

A low and broken range of hills lies on the westward. It is composed of blue limestone, obscurely nummulitic, and containing much coral. It blew a violent dust-storm all day. Height above the sea, 4,100 feet.

We have been gradually rising since leaving Khozdar. It is said that snow falls in the valley here. The corn is not so far advanced as at Khozdar.

3rd.—Marched to Banee, 13 miles; direction S.S.W. down the valley of Chota Greisher. The first portion of the valley is comparatively open and destitute of trees; lower down, the jungle becomes much thicker. Eight miles from Greisher we passed a fort on the right hand. As usual, it was built on a mound elevated about twenty feet above the plain. About a mile from our encamping ground, we came to the bank of a river flowing south and south-east. Its bed was densely covered with jungle and high reeds, and contained water in pools and

little streams. We skirted it for the distance of a mile, then crossed it to gain an open piece of ground where we encamped. The surface of the ground traversed had a blackish colour from the *débris* of the surrounding trappean hills, and pebbles and fragments of serpentine and clay stone, with occasional masses of compact nummulitic limestone, lay scattered thickly over it. The valley is here much narrower than it is northward, and some few miles further south is closed in entirely by a mass of hills. The river runs eastward through a gorge in the hills, it probably reaches the plain of Nal, and joins the Taigab.

I ascended the hill on the left, a portion of the Shah Sehan. It is about 1,000 feet high, and commands a fine view of the surrounding country. It was composed, from above downward :—

1*st*—Of the dark blue limestone, of the Siah Mountain, Khozdar.

2*nd*.—A dark grey crystalline limestone, with no fossils.

3*rd*.—Metamorphosed clay-stone, coloured red, white, and purple.

4*th*.—Serpentine rock.

At the base of the hill, I found many masses of a curious breccia, angular pieces of hornblende rock, greenstone, and serpentine embedded in a reddish brown, earthy matrix. The sides of the mountain were cut up by very deep and rugged ravines filled with moraines of angular stones. I should think the depth of these streams of stones at the bottom could not be less than twenty feet. We have now fairly entered Mekran.

5*th*.—Marched to Jibbery in the valley of Mushka; distance 14 miles; general direction SW. Passed down the bed of the river, through the belt of jungle, and skirted the base of the mountain range, by narrow and tortuous paths among low hills of argillaceous shale, the strata were leaf-like, and exceedingly thin and had a slaty cleavage running in two directions, either cutting each other diagonally, or at right angles, subdividing the rock into very minute angular pieces. We then passed up the bed of a dry watercourse westward, and entered a gorge in the hills, which completely cut through the range. The pass was narrow; and almost filled up with enormous stones composed

of a hard, compact, dark blue limestone containing nummulites. This rock formed the mass of the range on this side, and had a dip east of 70°. We now crossed a small plain in the bosom of the range, covered with blocks, from five to thirty feet square. The path led down a narrow and steep nullah with more of the big blocks of stone lying in its bed, and their tops covered with piles of small stones, formed by every Brahooee as he passes adding one to the general heap. This superstitious custom is general in Beloochistan.

The strata on this side the range dipped west. Passing through several minor ranges, many of which showed the varied colours of metamorphosed, and trap rock, we emerged on the valley of Mushka, and reached our encamping ground near the fort of Jibbery.

The valley is very extensive, pretty well watered, and cultivated. The wheat is in ear, and about two feet high, evidencing a warmer climate.

We passed through, on entering the valley, a continuous belt of jungle of the aloe-like plants called *pish* which we saw at Sekran. There were several palm-trees at the halting ground, and a stream of good water.

The fort, as usual, is built on an artificial mound. It is uninhabited, and falling into decay, but is larger and better planned than most others we have met with. It is built in three terraces, one above and commanding the other, and has a well in the courtyard: the stair-cases pass up through the centre of the walls. An outer wall surrounds the central rooms, and is loop-holed for musketry. The range on the opposite side of the valley is very high and impassable at any spot nearer than Gwujjuck.

6*th.*—Marched S.S.W. down the valley to Nokejo; eight miles. There is a great deal of cultivation in the valley; clumps of date palms are frequent; they also fringe the banks of the little streams that run down from the hills towards the centre of the vale. The land belongs to the Khan, and is farmed by different people. We passed a fort on the right hand, and there is a second near our halting place; both in ruins, and built, in the usual manner, on artificial mounds. Weather perceptibly warmer, 85° at noon. Height above the sea, 3,300 feet.

7th.—Marched S.S.W., down the valley to Gajer, distance 14 miles. Passed an isolated hill on the left hand, composed of the red and white limestone. The valley still continues well cultivated. It is about 17 miles in breadth, and stretches away south as far as the eye can reach. The path led amongst wheat fields for several miles; the wheat is three feet high and fully eared. The uncultivated ground is covered with jow jungle, interspersed here and there with a tree called by the Brahooees *patok*. Patches of aloe jungle are now and then met with. Before reaching Gajer we crossed the river,—here, a small stream flowing through the centre of a watercourse 150 yards broad. The natives say that it flows west and joins the Keelje river, but their statements are not to be depended upon. At Gajer the banks are covered with a dense grove of date trees, and the whole character of the scene resembles that bordering the Shat-el-Arab; the resemblance is probably greater when the river fills its bed. There is a mound on the right of the road, a few miles from the halting-place, surmounted by a stone wall, apparently the remains of a fort.

Gajer is a small village, situated near the remains of a fort built on a mound 30 feet high. The walls, 12 feet high, are of stone, and are loopholed. There is a good deal of cultivated ground around, but the inhabitants depend greatly on the crop of dates. Gajer is said to be exceedingly unhealthy during the date season, and the people have a cachectic appearance. There is a great mortality amongst the children. The language spoken is an impure kind of Beloochee. Height above the sea 2,900 feet. The river swells to a stream of considerable size after the rains in July, extending across to the date groves on either side, a distance of 400 or 500 yards. The dates are not considered very fine in this valley, either in size or flavour. The natives are now impregnating the female flowers, by placing a handful of the stamens in the sheath of the pistil.

The hill we passed, on the march to this place, is said to contain the remains of an old town. I therefore rode out to examine it, but on climbing to its summit, about 500 feet, all that the guide had to show was a little valley sunk into the bosom of the hill. It was covered with deep soil, on which grew a few

trees and shrubs. Doubtless the spot had been used as a place of refuge in former times. A narrow gorge led from it and drained off the surplus water after the rains, which had worn a channel down the face of the cleft. This end of the hill had been surrounded by a ghorbusta for the purpose of turning the refuse water to account. The hill was composed of the red and white limestone, surmounted by twenty feet of nummulitic limestone, blue in colour: strata conformable. The great range to the westward is about five or six miles distant. Its base is several hundred feet higher than the centre of the valley. The intervening space is cut up by deep ravines, covered with stones and dotted with patches of jow, pish, kaow, and ber bushes. It is sterile to a degree, and totally uncultivated; but whatever may be its condition at the present day, there is ample proof that the value of land was more fully understood at a remoter date. The whole of this tract, as far as can be seen north and south, is covered with the remains of ghorbustas. Parallel lines of stone walls, about 100 yards apart, exist from within half a mile of Gajer up to the base of the mountain range, forming level terraces one above the other. Many of them are very substantially built. Where broken through by nullahs, I found the walls to be from 12 to 15 feet deep, and 8 or 10 feet broad at the base. At the foot of the range, the ground was too broken and rough to be of use, and no bunds had been erected. The population of the country must have been very great to have supplied artificers for such stupendous works, and the value of land must have been also very great to have caused them to be undertaken. Enormous quantities of wheat must have been grown, and probably consumed on the spot. Now, no kushkawah (land dependent on rain) lands are sown, but grain is alone cultivated on the land which becomes overflowed at certain seasons by the river. On reaching the hills, I found a deep ravine running some two and a half miles into the range. It appears to be entirely made up of *clay-slate*, or varying at times with a slaty limestone. The slate also contained nodules and masses of this limestone. Around these, there appeared to be a concentric arrangement of particles, and the masses themselves, when decomposing by exposure, showed a tendency to scale off eccentrically.

The *cleavage* varied but little from the dip, but was generally more vertical. The dip was at first westward, but on towards the centre of the range it became vertical; then eastward; again changing to the west at the furthest point reached. In many places the strata were greatly contorted and twisted, this contortion had taken place subsequent to the cleavage being effected. The strata were divided by numerous joints, passing in a diagonal manner across the plains of cleavage.

When I had reached the end of the ravine, and had sat down by a spring of water, I suddenly heard a heavy body plunging through the air, and an instant afterwards, a great bale of mountain grass fell at my feet with a crash. On looking up, I discovered two Brahooees standing on a ledge 200 feet above me in the act of swinging off another bale. They proved to be grass-cutters, who not caring to drag the heavy bales of grass from the top of the mountain, chose this novel mode of getting their burdens to the ground.

15*th*.—Marched to Gwujjuck, 11 miles; passed south down the valley, saw three or four forts perched on the tops of low hills; one was curiously situated on the summit of a hill whose base was surrounded by a thick date grove which entirely concealed a village lying under the walls of the fort. The path wound through the grove, and passed through the village, the inhabitants of which all turned out to have a look at the "feringees." We crossed the river twice, and then skirted its right bank. On rounding the corner of a hill, the fort of Gwujjuck lay before us. It is built on a projecting mass of rock about 80 feet high, and is esteemed impregnable. It has been repeatedly besieged, but never with success. A former khan sat down before it for three weeks, and was then obliged to raise the siege. It belongs to Azad Khan of Kharan.

The river runs under the walls, and is bounded on the opposite side by a date grove. The surrounding portion of the valley is well cultivated. A village lies beneath the fort, but it is now deserted.

17*th*.—The Khan and his force returned from Punjgoor this morning, with the chiefs of that district and of Kedj. His entry into the valley was a very picturesque sight, preceded

as usual by his led horses and outriders, and followed by a long line of chiefs, with the banners of Sarawan and Jhalawan, extending across the valley horizontally. Then came the mass of his followers, mounted on their blood mares:—Beloochees from Kutchee and Brahooees from the mountains. Every now and then a horseman dashed to the front with a shout, and made his horse perform the most astonishing leaps and plunges. The men-at-arms rode mock tournaments, twirling their long lances round their heads. Others galloping to the front fired off their matchlocks, and tried the speed of their horses against each other in madcap races. The picturesque dresses, bright colours, and rude arms, made a picture that Horace Vernet would like to paint. Three or four miles from Gwujjuck are the remains of an ancient city whose site extends over a very large space of ground. I should think the walls might be traced for a distance of three miles. At first sight, they looked like a series of extensive ghorbustas, but on examination proved to be a vast collection of square enclosures. Some of these enclosures measured from 30 to 40 yards in diameter, and contained the remains of walls and subdivisions, partly buried in a sandy clay. The walls were built of stone, and still stood from twelve to fifteen feet in height. I saw no trace of any cement. From the general aspect of the ruins, I should think the city had been laid out in a series of separate enclosures, each containing its house; the houses of the chiefs being raised above the general level. The natives are altogether ignorant of the history of this city, to which, in common with all such antique remains, they apply the term of ghorbusta (works of infidels). The atmosphere is very electrical. I experimented in eliciting electricity from the fly of my tent this evening, by rubbing my back against the inner surface, when a stream of electricity followed; shocks, accompanied by bright flashes of light, passed through my shoulders, and the hair of my head stood up and emitted streams of light. On approaching the knuckle to within *a foot* of the excited surface, many discharges occurred in quick succession; and by the aid of the iron head of a hammer I obtained sparks fifteen inches in length. After rubbing the surface of the tent fly twice only, I obtained 102 discharges. On holding the hammer-head pretty

close, a succession of brilliant ones took place, and at intervals a bright spark was emitted from the opposite extremity, as if the iron was surcharged with electricity and discharged it again into the air. Many of the men here have brown hair, large brown eyes, and handsome faces. The men, as a rule, are much better looking than the women, amongst whom a face with regular features is rare. The old women get intensely ugly and haggish; probably they undergo a good deal of hardship and anxiety.

The stereoscope is an instrument of great wonder to the people. The Marwarree Sirdar of Kholwar came to-day to obtain medicine for his sick son, and I showed him some stereoscopic pictures of the neighbourhood. He was vastly astonished and delighted, and not a little mystified as to how I managed to get the fortress of Gwujjuck shut up in so small a space as the stereoscope.

There is a vast deal of difference with natives as to their capability of understanding pictures. A man to whom I showed a stereograph, and who had never seen a picture of any sort in his life before, detected at once the little figure of a man standing at the door of a mosque; while an intelligent native officer on being shown the large portrait of our Most Gracious Majesty naïvely inquired if it was a camel? The chiefs of Kedj have a peculiar cast of countenance, and differ greatly in appearance from both Brahooee and Belooch; they wear no beards, the complexions are quite fair, the hair is not allowed to grow long, and the physiognomy is of the Græcian type. They are probably of Rajpoot origin.

18*th*.—Marched back to Gajer. A few of that extraordinary sect, the Daees,* are met with here. They resemble the Brahooees in appearance, and wear the same dress. As far as I could learn also, portions of certain Brahooee tribes are Daees, such as the Sageta, Sakee, Shadu Zaee, Marlrow, &c. They have a moolla

* *Note.*—Wilson, in his "Ariana Antiqua," page 141, mentions the *Daæ*, amongst other Scythian Tribes, as associated with the *Massagetæ*, and in a map attached to Digby's translation of Quintus Curtius, their position is fixed a little south of the Jaxartes. This coincidence of association with the Sageta and Sakee, both then and now, is worth remarking.—*H. C.*

or priest, and a book. They say that they originally came from the westward near Kedj, where there is a city called Turbot. The sect abounds in Mekran, and has extended as far east as this. At the city called Turbot is a little hill of circular form called by them Ku Murad, on the summit of which is their principal musjid, where they meet at stated times to perform their rites. Here they appear to have arisen as a class (religious). Their prophet, ages ago, miraculously found in a tree, which they call "*Baru Kahoor*," a book, in which was written that they were to curse all Mahomedans, and set up a fresh religion. Instead of repeating "God is God and Mahomed is his prophet," they exclaim in derision, "God is God, but the Mother of Mahomed is his prophet." When a man marries a wife, the moolla has a right similar to that held by French seignors and English lords of the manor in the olden time; the woman is considered to be sanctified and cleansed by associating with the priest. They meet for religious purposes at midnight, at some house previously appointed, women as well as men. The ceremony is commenced by reciting the names of their prophet as follows:—

"Hadi Madi-Gedon Madi-Hadi a banazin, Madi a banazin, Surucra banazin." This is continued for some time; the fanatical excitement increasing until they throw themselves on the ground in a frenzy. After which, they chant the following words:—"Challar, Challar Ma likna, Vajanama yad kuni." This does not appear to tend to lessen their fanaticism, but on the contrary stirs them to madness. After a time, they give vent to their insanity; they suddenly seize indiscriminately on the women, no matter in what relation these may stand to them, whether of sister, wife, mother, or daughter, and when morning breaks they separate and go to their respective homes.

It is said that, on the grand occasions of their assembling on the Mount kū Mūrād, they further debase themselves by imitating the antics and movements of various animals, crawling on the ground and eating grass, &c. It is not to be expected that the state of morals amongst such a class as this should stand very high, and it is said to be of the very lowest description. An isolated hill (similar to the two others described as existing

in this valley) rises a few miles from Gajer, on the opposite side of the river. It has a strike of east and west, or at right angles to the valley, and a dip south. Height about 250 feet. It is composed of the red and white limestone, but of more compact structure than usual. It has almost a porcellaneous appearance in some places; and has probably been acted on by heat. This red and white limestone is capped (*i. e.* overlaid) conformably, by a dark-grey limestone, very hard and compact, which contains *alveolina* and a small nummulite. On the northern side of the hill, I found a dark, slaty limestone cropping out beneath the other strata. The section would therefore, stand thus :—

1*st.*—Grey limestone containing *alveolinæ* and small nummulites,—20 feet.

2*nd.*—Compact, fine-grained red and white limestone, with flints,—250 feet.

3*rd.*—Dark-grey, slaty limestone.

A series of low hills rise from the bed of the valley, consisting of recent sandstone and conglomerate, composed of pebbles and stones from the surrounding hill ranges. In many places, the strata have been raised at various angles. These elevations must, therefore, have taken place (comparatively) recently. The weather during the latter part of our stay at Gajer became exceedingly oppressive, and although the thermometer did not rise above 92° in the shade, the heat was of a very depressing and exhausting nature. I afterwards ascertained that it was hotter here, though raised 2,900 feet above the sea, than it was at the same time in Kutchee.

April 5th.—Marched to Nokejo. This part of the country appears to be almost destitute of game; a few deer are found on the plains; but although there is plenty of cover and food for partridges, hares, &c., they are remarkably scarce. Hoopoes, pigeons, doves, and a bird resembling the king-crow, black in colour with a forked tail, are almost the only feathered creatures met with. A very small grey owl inhabits the date-palms: its body is not larger than that of a thrush.

7*th.*—Halted. Rode out to the range bounding this valley, (Mushka) on the westward. As before stated, the range is very

high: I should think 3,000 feet. I had ascertained it to be composed of clay-slate at Gajer; but the backbone of the range was almost hid from our view at Nokejo by an intervening range of some 1,500 or 2,000 feet in height, which appeared to extend for a distance of ten or twelve miles. The ground at the base of the range was exceedingly broken and rough, and I had great difficulty in reaching it; and when there, could not ascend the mountain. As far as I could ascertain, from appearances, and from boulders and masses which had fallen from above, the composition was as follows:—

1*st.*—Dark coloured limestone, containing fossils of the nummulitic series.

2*nd.*—Red and white compact limestone.

3*rd.*—Dark blue subcrystalline limestone.

4*th.*—Trap rock.

This trap was principally composed of serpentine, but it varied exceedingly. In some places, it resembled dark green, almost black hornblende, in others green diorite, in others a purple amygdaloid basalt, and again greenstone (*vide* specimens). It is flanked by a low range of conglomerate made up of these rocks; and this has been raised in some places by the trap rock, apparently by a comparatively recent outburst, that is, since the great range has been upraised, and the conglomerate formed.

8*th.*—Marched to Jibbery. The country looks much greener and more luxuriant than it did when we entered the valley. The trees (pomegranates and apples) are in blossom; many wild plants in flower. A low thorny bush covered with a mass of white flowers resembling the convolvulus is a striking feature in the landscape. The "gishtas," a shrub with no leaves, growing to a height of about six feet, is now in blossom; the flowers are sessile on the smaller branches. They emit a fœtid and peculiarly sickening odour. The pish is not yet in flower; grass is springing up plentifully on the low hills. Weather still very hot. We found a large tomán of Brahooees of the Mamasauee tribe, on our old encamping ground. They had returned to their old haunts on hearing that the Khan had passed back to Kelat. Examined the hills on the eastward: they are of similar formation to the range on the west,—that described at Nokejo.

10*th*.—Marched to Juree, 11 miles; direction N. N. E. Passing up the valley we entered a gorge between the eastern range and an outlying mass of hills, which here jut out into the valley. This mass of hills is broken up into isolated portions, and the dip is greatly confused. The dark purple and black serpentine trap crops out every here and there, and forms low hills of curious shapes. It is greatly weathered, and the masses are crumbling down into mounds. It is overlaid occasionally by metamorphosed claystone, and this by a white subscrystalline limestone without fossils, which again in the ascending series is occasionally capped by a limestone bearing nummulitic fossils.

The path led in a winding manner through these hills, then turned westerly, and we halted in a narrow valley, where there was a spring of water. It was at first a little muddy pool, which hardly promised sufficient water for a troop of horse, but after 150 gallons had been taken out, there was a more plentiful supply than ever. There are one or two ghorbustas near. A very large one is passed just before reaching the halting-place; it is built on a mass of rock jutting half way across the deep ravine, through which a torrent flows at times. Its purpose is not so evident as usual. There is no trace of it on the opposite side of the ravine, and it appears placed too high to act as a dam. However, just beyond this, is another built across the mouth of a ravine, which was evidently intended as a dam. Height above the sea, 3,900 feet; we have therefore risen considerably since leaving Gajer.

11*th*.—Marched to Koda, 20 miles. We first passed out of the mass of low hills amongst which the halting-place is situated, and entered the valley of Mushka, up which we proceeded for some three hours. The centre of the valley is cultivated, and the waste ground covered with a high, rank grass. The ranges on each side gradually neared each other towards the north. On reaching the hills, we entered a deep nullah nearly filled with jow jungle. We then crossed a spur running across the head of the valley (formed of red limestone), and after passing over some very broken ground, crossed the spur of another hill, and halted in the bed of a river, which contained water in pools. The nullah was covered with jungle of very large jow trees. We

saw in these twenty miles, only two men, and no sign of any habitation. The country is very thinly inhabited, and the want of water very greatly felt. Without guides, it would be impossible to procure any.

12*th.*—Marched to Tyak, 18 miles. We passed northward over the spur of a hill, and entered a broad valley. The range on the right continues its N. N. E. strike; dip west; that on the left becoming less elevated northward. We passed on the left hand a low hill, of nummulitic limestone. After four hours marching we turned eastward, approaching the range of hills which bounds the valley on that side, and halted about three miles from it, in the bed of a river which, issuing from this range, runs south-west. Here are found several large pools of water, frequented by black duck and snipe. The country around abounds in hares, and is covered by the fragrant terk plant, a favorite food for these animals. A low hill rises behind the encamping ground. The strata dip east 75°. They are very thick, composed of dark blue limestone, but separated by intervening shaly limestone. This blue limestone is identical with that already met with, which appears to underlie the red and white compact limestone. The valley we passed through to-day is a very extensive one, but is uninhabited and uncultivated; it is called Bessemer. A road passes from this place diagonally across it to Kharan. From the summit of the hill behind camp I counted five parallel ranges of hills one behind the other, on the western horizon; through these the road to Kharan passes, for two marches. Though said to be very narrow, it is not difficult or rough, probably because the mountains are composed of clay-slate.

The pish shrub has ceased entirely. The last halting-place is the highest latitude to which it reaches. The Brahcoees, or rather the Mekranees, for it is essentially a Mekran plant, say that it is amongst plants what the camel is amongst animals, their everything. They twist rope from the fibres of the leaves; eat the berries for food; thatch their houses with the leaves, of which also they manufacture baskets, hats, and sandals. By tying together the end of a leaf, which is fan-shaped, they make a rude drinking vessel, which is usually found lying near the wells

and springs for the use of the passing traveller; and, in domestic life, the husband manufactures from it rude but ingenious models of animals for his children. Height above the sea, 4,750 feet.

14*th.*—Marched to Mujja, in the Kulgully pass, 16 miles. Passed north by east up the valley, skirting the flank of the eastern range, and having a lower range on the left. After a few miles these ranges approached each other, leaving only a narrow and very deep watercourse between, up which the path wound. The nullah gradually narrowed until it allowed of the passage of only one horseman. In three hours, we reached the summit of the pass. We now crossed an elevated table-land, and then commenced the descent by another watercourse, but the rate of descent was much less than that of the ascent,—Mujja lying much higher then Tyak. In four hours and a half from the time of starting, we halted in a ravine, near a spring of water. The sides of the ravines through which we passed gave a section of the strata of the mountain. The strike was N.N.E. and dip W. or W.N.W. at 70° or 80°.

The rock was composed of the dark blue massive limestone before spoken of, in thick strata, separated from each other by a more shaly limestone lighter in colour, and containing as far as I could determine, no fossils. The blue limestone strata were six or eight feet in thickness, and from being more compact and massive than the shaly-stone, had withstood much better the action of the weather, and frequently stood out in relief as mural barriers; these massive walls in many places had been broken through by the force of the torrent, and through these narrow openings the path wound.

At the halting-place, situated about three miles from the eastern mouth of the pass, the character of the rock alters, but I could not find the spot where the change takes place, the ranges here being much broken up, and forming isolated hills separated by deep ravines. The strata dipped W.S.W. and consisted of red and yellow marls, overlaid by a reddish coloured compact limestone, and underlaid by a conglomerate, formed of portions of variously coloured limestones (not nummulitic). Height above the sea, 5,700 feet. This conglomerate also appeared in separate hills 300 feet in height.

The order of the beds from above downwards appeared to be as follows :—

1*st.*—Reddish coloured, compact limestone, without fossils,—200 feet or more.

2*nd.*—Marls, without fossils,—(?) feet.

3*rd.*—Conglomerate,—300 feet.

4*th.*—Dark blue limestone, fossiliferous,—2,000 feet.

15*th.*—Marched to Mutt, 11 miles. Pursued at first a N.E. direction down the Pass, following the bed of the nullah for three miles; we then reached the plain of Mutt, and taking a N.N.E. course passed up the valley, perfectly level and covered with the terk plant, to the halting-place, near the bank of a small river which ran at the bottom of a deep water-course cut through the sandy soil of the plain. This is the Taigab which flows south towards Nal.

A square fort stands on the opposite side of the river. On quitting our encamping ground at Mujja, the hills were composed of the conglomerate spoken of yesterday. This continued until we reached the mouth of the pass, when a succession of low and broken hills followed. Beyond this we passed some thick and massive strata, having an easterly dip, composed of an arenaceous limestone filled with small foraminfera, chiefly I think *orbitoides* and *operculinæ*; it is identical with that which is found cropping out of the clays at Kelat.

There is a low hill north of camp composed of a hard, massive, light coloured limestone, containing small siliceous rounded or oval masses which appear to be concretions round nuclei of small sponges.

16*th.*—Halted. Examined the ranges bounding the valley westward, distant about six miles. The range is here broken through, and a pass leads southward into the valley of Bessemer. It is said to be rougher than the Kulgully Pass, and only used by travellers journeying to Kharan. The range through which we entered the valley passes N.N.E. for six or seven miles, and then ceases. An interspace of some two miles succeeds, and then the boundary is continued N.N. Easterly by another range. The southern end of this turns westerly, and cannot be further traced. The northern extremity of the Kulgully range

ends naturally, presenting a dip in three directions, E., W., and N. The superficial strata are composed of nummulitic limestone; I could not reach the underlying rock. The level of the ground rises as the range is approached; and, as usual, is greatly cut up by ravines. In the interspace forming the pass, the ground rises some 150 feet above the level of the plain. About two miles beyond the entrance, it suddenly ends in a precipice overhanging a narrow water-course, along the bottom of which the path runs. Bounding the horizon on the S. W. ran a line of blue hills across the head of the Bessemer valley, which appeared to be a vast spur from the Kulgully range. I was unable to reach the range northward of the pass. It presented a scarped face to the east, and a dip westward (as do all the ranges west of the longitude of Kelat). From its dark colour and general appearance, I believe it to be composed of slate. To give some idea of the vast number of sheep which are fed on the short aromatic grass of the hills, I may mention that I met with ten flocks, each averaging more then 100 sheep and goats. They are valued at from two rupees to two rupees and a half each, and three rupees for a milch goat.

The thermometer fell last night to 34°, with a maximum of 90° in the day.

17*th.*—Examined the ranges bounding the valley eastward, distant about seven miles. About a mile from the opposite bank of the river, I reached a series of low hills composed of the red and white limestone (compact); dip west. Four or five miles from this, reached low hills having a N.N.E. strike, and dip W. at 30°, composed of argillaceo-arenaceous limestone, dark grey in colour, containing a few indistinct fossils. North of this, and almost in the same line, I found a low hill of coarse sandstone.

Proceeding westward, I reached some low hills composed of a grey limestone, in some places subcrystalline, of the same strike and dip; and underlying this conformably, an indistinctly stratified chert. The chert rock was subdivided into minute pieces, by joints and divisions running at right angles to each other, and the surfaces of the rectangular masses thus formed were coated with a thin layer of carbonate of copper. I could

not find any separate vein of this mineral, and the thin laminæ would probably be of no economic value, as the mineral is diffused over too great a space. About 10 or 12 feet of the chert protruded above the ground, and where it was in contact with the limestone, the latter had become slaty and flinty. I could not detect the trap rock which had thus altered these rocks, but it doubtless lies but a short distance beneath.

Further westward, I came upon hills of greater height than the foregoing, of the same strike and dip, composed of the red compact limestone, underlaid by purplish or chocolate coloured shaly strata, and these by a light blue compact limestone, similar to that met with in the Hulwaee range at Khozdar. This was followed by the dark blue fossiliferous limestone (of the Siah, at Khozdar).

The underlying limestone then formed a succession of ranges one behind the other, attaining a height of 800 or 900 feet. All these strata were conformable to each other, and the series is very similar to that we have before met with. From their forming a succession of low ranges separated by intervening tracts of level ground, I could not estimate their individual thickness. In returning, I visited a hill which rose from the plain some three miles north of the line by which I had come. It rose to a height of 250 feet. The strata were horizontal, of twelve or fifteen feet in thickness, and composed of a conglomerate, formed of all the rocks I have described. The fact of the ranges being flanked by a conglomerate formed of rounded stones from their various strata, appears to be a common one throughout the country, though from subsequent changes and denudations, this conglomerate is not always found in connected masses.

18*th.*—Marched to Gidar, in the same valley; distance eight miles,—direction N.N.E. Passed three forts *en route*. There is little or no cultivation around.

Examined this afternoon the range to the eastward (the same as that mentioned yesterday) about six miles distant: it is named Chood by the Brahooees: some low hills intervened, composed of the red and white compact limestone. The range was of the same composition as its southern portion described yesterday; but cropping out about 100 yards from the base

was a mass of trap composed of a greenish, earthy serpentine with bright specs of pinchbeck diallage. In a low hill near, this trap was overlaid by crystalline limestone (freely effervescing with acid), containing cavites filled with ochre. Some of this rock appeared almost vesicular and contained dark-green specks disseminated through it. I found no trace of copper.

19*th*.—Marched to Sohrab, 16 miles, direction N.N.E. up the valley. Passed a good deal of cultivated ground, on leaving Gidar, and a large fort on the right hand about two miles distant. About ten miles north of Gidar, a range commenced on the left hand and continued in an E.N.E. direction for some five or six miles; when about two miles from Sohrab the road passed through it. It is composed of the red and white compact limestone, with rather more than usual of the flint slabs. The strata in many places were contorted and twisted; dip N.N.W. Pebbles of nummulitic limestone were frequent on the plain. Sohrab is rather a pleasant spot; there are several small villages surrounded by gardens, containing mulberry and apple trees, and by extensive fields filled with wheat and lucerne. One or two rills of clear water flow from the hills eastward.

20*th*.—The Chood range ceases a few miles below Sohrab, then follows a break in the line of hills eastward, through which passes the road to Angira and the Moolla Pass. North of this commences a range which is more or less continuous, until it reaches Kelat. The northern portion is called the "Syad-Ali-ki-tukker." The strike is N.N.E. and dip E. or E.S.E., presenting therefore a scarped face towards the valley. It is composed essentially of nummulitic limestone. On reaching the base, I found 60 feet of a white limestone without fossils: this was followed (upwards) by a compact, hard limestone containing *alveolariæ*, whilst the valley was sprinkled over with pebbles containing true nummulites which doubtless came from the highest or most superficial strata. Height of Sohrab, 5,770 feet.

21*st*.—Marched to Surmasing, 17 miles; direction, north by east. On the left hand, low, ragged, irregular hills intervened between us and the great range which is continued up from Gidar. These low hills are formed of the red and white limestone. The river we met with at Mutt (the Taigab) has dwindled

into a dry watercourse. It takes its rise between Rodinjo and Kelat. Its bed, however, contains water at Gunduggin, a halting-place, and caravanserai that we passed a few miles from Surmasing. The water, however, is of a dark colour and impregnated with sulphuretted hydrogen, from which probably the spot derives its name. There is no village at Surmasing, it is merely a halting-place with several pools of water in the bed of the river, which, like that of Gunduggin, is highly impregnated with sulphuretted hydrogen. This is explained by the nature of the hills around. They are of a black colour, and composed of trap rock. From the black colour of the stone, the spot has been named "the rock of antimony;" but I believe none of that mineral is obtainable here. The ground around is covered with an efflorescence of salt. The following is a section of a hill near, from below upwards :—

1*st.*—Trap, green, basaltic in structure, but in some places containing scales of mica, in others crystals of hornblende,—8 to 10 feet.

2*nd.*—Dark green, compact rock, apparently stratified,—6 feet.

3*rd.*—Cherty limestone, in some places crystalline, with bands of chert interleaved,—8 feet.

4*th.*—White subcrystalline limestone,—12 feet.

5*th.*—Purple shales,—40 feet.

Again from below upwards :—

1*st.*—Massive unstratified basaltic rock, of a green colour,—15 feet.

2*nd.*—Metamorphic strata,—20 feet.

3*rd.*—Shaly limestone, greatly divided into minute angular fragments by cross cleavage ; under strata slaty,—30 feet.

4*th.*—Purple or red limestone.

At another place :—

1*st.*—Greenish trap,—6 feet.

2*nd.*—Greenish arenaceous rock,—8 feet.

3*rd.*—Green flinty (cherty) limestone,—4 feet.

4*th.*—White limestone, with bands of flinty limestone.

A narrow mass of the trap had been intruded up through the overlying strata to this rock. The limestone in the vicinity of this dyke was chertified.

22nd.—Marched to Rodinjo; 12 miles, direction N.N.E. Height above the sea 6,580 feet. There is a small village here surrounded by mulberry, apricot, and willow trees. It is watered by one or two rills of water flowing from the eastern range. On the road, we passed a series of low hills of the red and white limestone strata nearly vertical.

West of camp, about six or seven miles, arises a mass of hills, of great height, easily seen from the neighbourhood of Kelat, called Chandram. They are composed chiefly of the dark-blue, underlying limestone, but I have not yet been able to examine them thoroughly. Eastward is a partial break in the range leading into the valley of Toke. North of it, the line is again carried on by the Syad-Ali-ki-tukker. As before stated, it has a dip east, and presents a scarped face to the valley. Flanking this are low hills of many coloured clays. I rode out and examined them this afternoon.

These hills are rounded in form from the yielding nature of their material, and are composed of marls, clays, and loams; greyish white, (covered thickly with fragments of carbonate of lime, in crystals,) green, purple, red, chocolate, &c. They are probably analogous to the coloured, argillaceous series described by Mr. Carter as underlying the white and nummulitic limestone on the S. E. coast of Arabia; and are interstratified here also by thin shaly layers of limestone and sandstone. I could not detect any fossils. In appearance they correspond to the coloured strata of Kelat, but in reality differ widely. Outcropping from the summits of those nearest the base of the hill, was a green trap rock, resembling that formed at Surmasing, and a green compact stratum not effervescing with acid. Then followed in the ascending series :—

1st.—Twelve feet of extremely thin arenaceous shale.

2nd.—A greyish semicrystalline saccharoid limestone, with minute separated crystals of carbonate of lime; 20 to 30 feet.

3rd.—A thick stratum of conglomerate, not containing nummulitic limestone pebbles, but made up of rounded masses of siliceous limestone, of various colours, and of flint or chert, in a sandy matrix.

The sandy element predominated in the upper layer of this rock, and at last formed a coarse sandstone,—thickness 20 feet.

4*th.*—A limestone resembling No. 2. nearly filled with minute points of crystallized carbonate of lime, which, however, here had a rounded form, and looked like the casts of minute foraminfera,—thickness about 60 feet.

5*th.*—Limestone containing less of these points passing into a compact, hard, white limestone containing, *assilina* and *alveolina*, with a few indistinct nummulites, thickness 200 feet (?) What lay above this I was unable to say as I could not reach the summit of the hill, but in the Toke valley I found, last year, fragments of true nummulitic limestone, with well-marked and fine specimens of *assilina.*

23*rd.*—Marched to Kelat,—14 miles. The road gradually ascended until within two miles of Kelat, when the watercourse took a different direction, running N.N.E. into that valley. The commencement of the Taigab River which we have thus traced up to its source for a distance of 100 miles, was passed about six miles from Kelat,—here, a narrow nullah, issuing from the hills. There was water, however, in its bed in many places, rain having fallen a day or two previously.

General Summary.

Heights in Feet, obtained by the boiling point of water.

Route towards Mekran.	Feet.	Return Route.	Feet.
Kelat	7,000	Juri	3,900
Panderan	5,690	Tyak	4,700
Nogramma	4,700	Wujju (in the Kulgully Pass).	5,700
Baghwana	4,400	Mutt	5,330
Khozdar	3,300	Sohrab	5,770
Nal	3,390	Rodingo	6,580
Taigab	3,600		
Greisher	4,170		
Nokejo	3,380		
Gajer	2,960		

The above is a table of the heights of various halting-places on the line of route, and will serve to show to some extent the

outline of the configuration of the country (for which reason I have collected them into a tabular form). It will be seen that the starting-point, Kelat, is on the highest inhabited valley, and that the descent is very marked as we proceed south to Khozdar. From thence to Greisher within the boundary of Mekran, there is a considerable ascent, after which the descent is gradual to Gajer, in the valley of Mushka. Kelat indeed is situated on an elevated ridge which runs N.N.E. by S.S.W., in its parallel of longitude throughout the country. On both sides of this line the descent commences, and it was this ridge that produced the elevation at Greisher, which we crossed in a S.W. direction from Khozdar to Jibbery. The elevated position of Kelat in comparison with the rest of the country will be more apparent when we remember the gradual rise in passing southwards from Quetta to Kelat, as given by me in a former report. In that report I also mentioned the very evident *parallelism* of the mountain ranges, and suggested that it was probable that this held good throughout the country. This has been thoroughly borne out by observation during the trip described. The only point of disturbance of this regularity is in the line of the Moolla Pass which cross-cuts the ranges from the eastern flank to the centre, and has thrown them out of their usual order:—a phenomenon which occurs also to a certain extent in the Bolan Pass. East of the parallel of Kelat, if that line be drawn N.N.E. and S.S.W., the ranges have a general dip toward the east; west of that line, they dip towards the west, the regularity of the series being broken, of course, in the neighbourhood of the great Passes.

The prevalent idea that Mekran is nothing more than a vast desert is certainly a mistake.* Though not penetrating far into

* *Note.*—Mrs. Somerville says in her "Physical Geography," page 50:—"Kelat the capital of Beloochistan is 7,000 feet above the level of the sea; around it there is cultivation, but the greater part of that country is a desert plain, over which the brick red sand is drifted by the wind into ridges like the waves of the sea, often 12 feet high, without a vestige of vegetation. The blast of the desert, whose hot and pestilential breath is fatal to man and animals, renders these dismal sands impassable at certain seasons."—How far this is applicable to Beloochistan I leave the reader to judge. The learned authoress has evidently confounded the desert of Seistan (hardly to be considered a natural division of Beloochistan) with the hill country, and draws her description of the whole accordingly.—*Author.*

the country, we were enabled to glean much information from natives of Kelat, who had frequently visited it, and from the Mekran chiefs who returned with His Highness the Khan. The country, unknown as it is to Europeans, is, of course, no mystery to Brahooees, who, either for the purposes of commerce, or as forming portions of the various forces that have, from time to time, been sent thither by the Khans of Kelat, have traversed it in every direction. The valleys Greisher and Mushka have been shown to be extensive and bounded by high parallel ranges. West of Gwujjuck these ranges extend for three days' journey in breadth, and from this point to Punjgoor are a succession of similar ranges, and valleys.

The valley of Gitch, the next one of any size west of Mushka, is 60 miles in length, and cultivated south-west of Gwujjuck; after crossing the next great range, the traveller enters the valley of Kholwar, broad and extensive, watered by wells, producing, like the valley of Mushka, wheat, barley, and a few dates. Beyond this it crosses other ranges, having the old direction, and reaches Kedj, around which the hills are low. Westward of Punjgoor there is a cessation of hill-chains for 60 or 80 miles, where a strip of the Desert of Seistan is prolonged southward. Beyond this, there is a recommencement of the hills having the old strike, and so on until Bunpoor is reached which has been described by Pottinger. West of Kedj are a succession of as well-cultivated valleys as those of Kussurkund, Gahi, &c. It will thus be seen that the maps as at present published are very incorrect.

The great range running east and west and marked "Wushuttee Mountains" (the ancient Bœtti) in Pottinger's map, is nothing more, I feel convinced, than the ends of a series of ranges having a N.N.E. and S.S.W. strike.

And again, the range without a name running parallel to the sea-coast in the same map, is formed in the same way, of the southern ends of a consecutive series of ranges. We met with numerous instances on our route, where the ends of a number of parallel ranges presented the appearance of a range running at right angles to the real strike. I might mention, as instances, the Hulwai group bounding the Khozdar valley on the north; the group bounding the Baghwana valley on the south; the group

bounding the Greisher valley on the north, &c. All these appeared to be, when passing at a distance, unbroken ranges running east and west, but on a closer inspection, proved to be the terminations of hills, which had thus strangely ceased at one continuous line, as if they had been cut short off. Punjgoor lies much higher than Kedj, and has a more genial climate. Its harvest (wheat) takes place in May, whilst that of Kedj is gathered in February, and of Kolwar in March.

The climate of Mekran generally, but especially of the level tract south of the mountains, is very unhealthy. Fevers, of a peculiarly bad type, and accompanied by great hepatic derangement are rife, particularly at the season of the date ripen ing (August). On every occasion of the natives of Kelat having visited it, they have suffered severely. The plague of flies at this period is said to be beyond belief: they far exceed in number those of Persia and Egypt. Those who visited Mahumrah in 1857 will be able to form some idea of the magnitude of this evil. The products of the country are corn and dates, and around Kedj a little cotton is grown. The dates of Punjgoor are celebrated throughout this portion of Asia and at the ripening, caravans come from all parts to buy and barter. Gedrosia, the ancient Mekran, was known to the Greeks from the passage of Alexander and his army through it. The boundaries are correctly given, but not much is to be learned from the description of the country. Alexander leaving Sind probably marched in the direction of Beyla, and thence crossed to Jow. He here met with a very difficult Pass, at which the natives of the country (Oritæ and Gedrosias) assembled to oppose him. This pass crosses, and cuts through the mountain ranges (two) S.E. of Gwujjuck, and is described by the natives as a very difficult one. He forded the Arbis (the present Purate), and then further west a smaller river which was probably the one which we left running south from Gwujjuck. It is only of any considerable size after the rains, in the autumn, when it becomes a river of 250 yards in breadth. He now kept near the coast for some distance, passing through the present district of Kholwar, where, as he describes, water is very scarce in the dry season, and found only in wells at long distances.

His track lay therefore south of the mountainous country. He now suffered greatly for want of supplies. He probably started on his journey in April, and on reaching Mekran found the crops cut (as they now are at this season). Northward, however, in the cooler elevated regions, there was still a supply, and we are told by Arian (Chapter xxiii.), that, "Passing [probably sending] through all the country, and gathering as much as could be procured, he ordered Cretheus the son of Callatianus, to convey it to the sea-coast for the use of the army on board [the fleet]. He moreover commanded the natives to bring him as much corn as they could, ready ground, as also a quantity of dates and cattle from the *higher parts* of the country." After suffering greatly from the heat and difficulty of crossing the sandy desolate country near the sea-coast, he appears to have marched north-westward and reached the chief city or capital of Gedrosia.

Arian at the end of the 26th Chapter says :—"Then his guides, assuring him that they knew the way again, left the sea, and led the army into the inland parts again."

Resuming his way he crossed the barren tract of country mentioned as extending south from Seistan, and then reached the fruitful valley on the western border of Gedrosia (the present Bunpoor).

Quintus Curtius says, book ix :—"They came at last upon the frontiers of the Gedrosians, whose territory was very fruitful and afforded plenty of all things." From thence he passed into Carmania (the present Kirman). Had he started *earlier* it is probable that he would have suffered less from want of supplies, as the crops would still have been on the ground, and if *later* the dates would have been ripe. That they were not is evident from the fact stated by Strabo (book x. and chapter ii.), —"Many persons were suffocated [surfeited ?] by eating unripe dates."

At the present day there is nothing to prevent a large force of Irregular Asiatic Cavalry from marching from the borders of Persia through Mekran, and appearing without any warning on the frontiers of Sind.

The first Nusseer Khan of Kelat marched to Kedj, thence to Bunpoor, and back by way of Kharan and Nooshky, accompanied by 12,000 troops. This fact sufficiently shows the practicability of the route for an Irregular force.

Ghorbustas.

I have mentioned repeatedly in this journal, the presence of ghorbustas or ghorbunds, on the line of march;—structures at times almost bearing a resemblance to the Cyclopean remains of Europe. They are evidently traces of a people, who occupied or passed through the country long prior to the advent of the present occupants, who know nothing of the builders, or of the uses of the buildings, but, as before stated, attribute them to Kaffirs or Infidels. They are found usually in out-of-the-way places, narrow valleys at present stony and barren, and present the following characteristics.

They are placed always on declivities, or across the mouths of ravines. Their solidity and size are proportioned to the steepness of the declivity; thus, where there is only a gentle slope the walls are narrow and low and slightly built, but where the descent is great and the flow of water after floods and rains would be violent, they are of great thickness and height, and, as seen in the valley beyond Baghwana, supported and strengthened by buttresses or walls built at right angles. They always present a scarped face to the descent, and the opposite side, when well preserved, is levelled off with the surrounding and superior ground. Those built across the mouths of ravines are very solid, and high, and usually the builders have taken advantage of some mass of rock jutting out as a sort of foundation. Those on slopes are never seen singly, but always in numbers varying with the extent of the ground to be covered, and placed in succession one behind the other. The intervening ground being levelled is thus formed into a succession of terraces. These facts can lead, I think, only to one conclusion, namely, that they were connected with the irrigation of the country.

Those built across ravines were intended to form tanks for the preservation of the water that came down at irregular intervals in floods. Those on slopes, to economise the distribution of the water;—the surplus water of one terrace running over

and flooding the lower one, depositing as it went a layer of surface soil. The ground thus levelled of course became more valuable, freed from the irregularity and roughness which characterise these narrow stony valleys.

It has been argued that they were intended for defence, and that like structures exist in the north-west which have been used unmistakeably for that purpose; but a series of low-level terraces, in many cases not raised more than two or three feet above each other, were surely not adapted for defence, and the uses of the higher and stronger ones appear to me so evident, that after examining some hundreds of them I cannot subscribe to this opinion.

They are almost confined to the province of Jhalawan, and are largest and most important in the southern and south-eastern portions of the province. I have mentioned the ancient city at Gwujjuck; that it is of the same date, and constructed by the same people, I think extremely probable.

From the numbers and position of these structures, the people who built them must have been extremely numerous; must have felt that the country as existing by nature was utterly incapable of supporting them; and they must have been possessed of an energy and ingenuity which the present races are totally without. It appears probable, nay, almost certain, that they must have swarmed eastward over the mountains from Mekran, making their appearance on the S.W. portion of the table-land. Gradually pushing eastward and northward, as their numbers increased, either rapidly by additions from without, or more slowly by increase of the population from within, they ascended to the various valleys as high as Kelat, when, discovering the great eastern outlet, the Moolla pass, they found an exit by it into the plains of India.

How long they remained on the table-land; from whence they originally came; and over what countries they eventually distributed, are alike mysteries.

Lieutenant Aytoun, in his Geological Report on a portion of the Belgaum Collectorate given in Mr. Carter's "Geological papers on Western India," page 392, mentions that certain gorges in the hills had been artificially bunded. He says,—"Another

gorge is met with in this west range, in the same line as the last gorge, which had formerly been artificially bunded. I was informed that, on this sandstone range, there were two of these gorges, and that both were formerly barred by artificial means but that floods had swept them away." Is it possible that they are traces of the handy-work of the ghorbusta builders of Beloochistan ?*

The structures which I have called *Lingums*, doubtless owed their origin to the Hindoos who occupied Beloochistan prior to the Mahomedan invasion ; they too, are almost confined to Jhalawan, where the Hindoo element was most prominent.

Summary of the Geology.

Nummulitic Series.

Lower Tertiary. Forming the mountain ranges of the Herbooi and those extending eastward of the longitude of Kelat. Consisting of compact white, or reddish white limestone, containing *nummulites, orbitolites, orbitoides, operculina, assilina, alveolina* (of large size), and fossils of the nummulitic series. Thickness unknown, probably more than 1,000 feet.

* *Note.*—There are one or two points of slight resemblance between the "Pelasgi" the builders of the Cyclopean walls of Greece, Italy, &c. and our unknown friends the ghorbusta builders, though I by no means wish to prove them the same people, but rather to suggest that they might have been a *kindred people* with *kindred habits.* The Pelasgi came from Asia, not from Asia Minor, not from Syria, not from Assyria, not from Persia, but probably from that birth-place of emigration—the tract north and north-east of Persia.

The ghorbusta builders probably, came from the same tract and were not Mekranees, nor Persians, nor Assyrians. The Pelasgi, existed only a few generations in Greece (about 250 years) before they were turned out by the Hellenes; they must therefore have brought with them, when they entered the country, their propensity for building massive walls, and commenced their work almost immediately on arrival. It was probably the same with the wall-builders of Beloochistan, they only remained in the country long enough to allow them to extend northward as far as Kelat, when meeting with the Moolla Pass, they débouched into the Plains. Their art was a fully developed one, before they arrived here to carry it out. The Pelasgi arrived in Greece about 1800 B. C. This date seems to accord roughly with the advent of the unknown people into Jhalawan.

The ghorbusta buildings differ considerably, however ; for when compared with the Cyclopean remains, they are slight, most roughly executed, and insignificant ; yet they evince a like instinct and habit in two races which probably came originally from the same region.—*Author.*

Sub-Nummulitic Series—(Upper Cretaceous ?).

Secondary.

Limestone strata, differing in character; compact, sub-crystalline, saccharoid, at times cretaceous; containing *assilina, alveolina* (small in size), occasionally *orbitolina,* and minute indistinct foraminifera; passing downward into coloured argillaceous strata. Thickness from 200 to 500 feet (?)

Lower Cretaceous (?)

More or less compact, fine-grained red and white limestone interleaved with slabs of flint or chert; the limestone generally containing fine microscopic specks, and the upper part one or two massive strata of an excessively hard limestone abounding in *orbitoides, orbitolina,* and *operculina.* The lower strata becoming argillaceous, shaly, and containing (rarely) ammonites. Thickness 2,000 feet (?)

Dark blue fossiliferous underlying limestone, containing strata, yielding lead ore. Thickness 2,000 feet (?).

Clay Slate, thickness 2,500 feet (?), and *Granite* (?)

1*st group,* from above downward. From Kelat to Nogramma, as we passed through the Herbooi Mountains, we met with nothing but nummulitic limestone. The fossils then obtained have already been forwarded to Bombay, and the characteristics of this series have been given in a former report.

2*nd group.*—The sub-nummulitic rock, was met with on our road back, at Sohrab, and Rodinjo. It underlies conformably the above. The argillaceous strata intervening between it and the fourth group, vary much in thickness in various places. At Rodinjo they formed low hills of considerable extent. In the valley of Mushka they were entirely absent; the upper compact strata, of this group, containing *alveolina* overlying conformably the red and white limestone.

3*rd group.*—At Gwutt in the valley of Nogramma we came upon the red and white compact limestone with flint slabs. As this formed a separate hill in the centre of the valley, the inter-

vening strata mentioned above were wanting. This limestone belongs to the secondary period, but its position in this series is doubtful.

At Kelat it underlies the strata bearing orthoceratites, which would apparently place it below the Cretaceous Series. This, however, can only be determined when the real position of the Kelat strata is fixed. Its distribution is most extensive throughout the country. We met with it again at Baghwana forming hills 1,000 feet high; at Khozdar, 2,000 feet; and south westward along the valley of Mushka, when it formed three separate hills (in the floor of the valley) from 300 to 600 feet high. Its lower strata at Khozdar passed into argillaceous beds in which I found an ammonite of the same species as one of those found at Kelat. The amount of flint (of a cherty nature) it contains varies. At one place, I estimated the slabs to form one-sixth of the whole thickness.

4th group.—The abovenamed limestone, rests conformably, at Nogramma, Khozdar, and Mushka on the *dark blue limestone* containing fossils, *Rhynchonella, &c.*, with indistinct casts of univalves whose names I have not been able to determine. The position to be assigned to this must, of course, depend greatly on that given to the overlying rock.

5th group.—The valley of Mushka we found to be bounded to the westward by ranges composed of *clay-slate.* Although this formed a separate series of mountains, and I did not actually find the blue limestone overlying it, yet there can be no doubt its position is inferior to that rock.

We have now only to consider the *igneous rocks.* The first place in which we met with the trap-rock was on the road from Ferozeabad to Nal. It consisted chiefly of serpentine (euphotide), forming low broken hills resulting from the eruption of trap. Accompanying it, were broken strata of metamorphic rock, white marble, &c., showing that the trap had been intruded through and had broken up the overlying calcareous strata. The next spot was at Nal. Here the trap consisted of various kinds of rock, serpentine, diorite, hornblende, &c. It was capped by a nummulitic limestone, the lower strata of which showed evidences of the action of heat.

From thence S.W. to Gajer we find the trap forming an important element in the constitution of whole ranges, and on our return route towards Kelat it was still met with ; but north of Juri it had lost much of its serpentine and had become more dioritic and basaltic.

The village of Surmasing had been a point or centre of eruption. It struck me repeatedly on our march that the line of original intrusion was also the direction of subsequent outbreaks along the base of many ranges, as at Nokejo, Jibbery, Mutt, and Gidur there appeared to have been an eruption subsequent to that which had raised these ranges.

Of the plutonic (hypogene) rock I have obtained no distinct evidences. That it does exist, however, near the mountains at Sekran, I have proof in the masses of granite rock found scattered there, and in the bed of the river which, flowing from thence, passes through the valley of Khozdar: perhaps a more extended search in those mountains would have detected it *in situ*.

The many points of resemblance between the geology of this part of Beloochistan and the geology of the S.E. Coast of Arabia, given by Mr. Carter, will be apparent to geologists ; and doubtless a more critical and extended survey than I have been able to make, combined with a more practical knowledge of geology than I at present possess, would have made them more evident ; but having done as much as lay in my power, I can only hope that, little and imperfect as it is, it may prove useful.

Specimens of the rocks and fossils gathered on our route have also been forwarded.*

* These are deposited for the present in the Museum of the Bombay Asiatic Society.—*Ed.*

ON A NEW AND STRIKING FORM OF FUNGUS DISEASE, PRINCIPALLY AFFECTING THE FOOT, AND PREVAILING ENDEMICALLY IN MANY PARTS OF INDIA.

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Presented March 1860.

THE affection under consideration is not of unfrequent occurrence in the Bombay and Madras Presidencies, and has been several times noticed, and cases of it described, but until the present time, its pathology has remained obscure. Its true nature, as I believe, is referred to in the title of this paper, and thus interpreted, the disease must be regarded as in many respects unique.

Its distinguishing character is the following, that certain *particles* or *masses* are invariably present in the structures implicated, besides being frequently found in the discharge. These I consider it correct to look upon as FUNGI principally from their structure; although their *habitat*,—in the very textures, or parenchyma of the organ, and amongst sound parts,—appears, to say the least, a very unusual one for fungi.

There can be no doubt, too, that they are the exciting cause of the disease, and not merely accessory or secondary phenomena. With regard to one variety of the affection, now for the first time brought into notice and described, this is beyond all controversy, and everything is in favour of the other and more frequent variety having a similar relation to the symptoms.

With this brief summary of the subject, I proceed to the history of the disease, and to the narration of cases, and observations on them, which have led me to the conclusions now stated.

Literary Notices of the Affection.

It is nearly twenty years ago, as far as I can make out, that Surgeons in India first remarked, in their official reports and separate communications, an affection of the foot which it was not possible to refer to any of the better known diseases, one or other of which, however, it was generally stated to resemble. It would appear that one of the earliest notices is that by a Madras Surgeon mentioned by Dr. J. Colebrook (Madura Dispensary Report 1848), then Zillah Surgeon, Madura. He states that Dr. Gill, in his Report for 1842, gave a short but graphic account of the disease, quoting the following extract:—"When the leg has been amputated, the foot has been found to be one mass of disease of a fibro-cartilaginous nature with entire destruction of the joints, cartilages, and ligaments; it has neither shape nor feature, and is covered with large fungoid excrescences, discharging an offensive ichorous fluid." This description I may observe is neither clear nor quite correct.

In the Report of the Public Dispensary at Bellary for 1844, Garrison Surgeon Godfrey has furnished a far more full and satisfactory account. (From specimens in my possession, I know that the fungus disease is the same at both Madura and Bellary.) Mr. Godfrey, after stating that many patients with ulcers and sinuses are seen, proceeds to distinguish certain cases, returned as "*ulcus grave*," in which the foot is so affected as to require amputation. Two carefully described by him present all the chief characteristics of the *fungus disease*. Considering them as "dissimilar in several respects" from any disease he had been able to find recorded in books, and also in various particulars from elephantiasis, and looking upon them as being apparently a local tubercular affection, he would designate the disease "*morbus tuberculosis pedis*." This name it has retained in Madras. Mr. Godfrey had seen three other instances; and he considered that the successful result of amputation may tend to show the advantage of removing tubercular structure as early as possible, not only from the foot, but perhaps from any parts of the body, where an operation would be practicable. It is also further argued that, but for the operation, the system might have become

contaminated; so far, I may be excused for observing, does an erroneous pathology influence both the theory and practice of medicine! In the Report for 1845, two other successful cases are recorded by Surgeon Godfrey, and in one of them it is noted that the amputated foot contained a considerable black deposit, much resembling fragments of coal; but, says the operator, "at present I consider it as an accidental product in, but not forming part of, this peculiar disease of the foot:" he looked upon it as melanotic, and as showing that melanosis may be quite black in man. It is almost certain that this black deposit (contained in a cyst the size of a small walnut) was identical with the growth I have presently to describe, viz. that it was a fungus mass. Some other instances are referred to, and in the Lancet, May 30th, 1846, the above cases are recorded as belonging to a "disease of the foot not hitherto described." It may be added that the worm-eaten and roughened appearance of the bones was noticed by Mr. Godfrey, and I shall hereafter show that the changes which occur in them are quite characteristic.

No doubt the fungus disease has long been known in Bombay, although, on account of its comparative unfrequency, not so early noticed. On a cursory examination of the Records, however, I find a case occurring at the Jamsetjee Jejeebhoy Hospital in February 1846, which is called by Dr. Morehead "*Hypertrophy of one foot, with diseased metatarsal bones.*" The patient, a man, æt. 40, and suffering for 7 years, was from Kattywar—a district where the *fungus disease* is common; and there is no doubt in my mind, from reading the description of the case, that it, too, was of this nature.

By this time the endemic character of the affection was known; the term "*Madura foot*" being commonly used in that district. Colebrook, who states this, also gave it as his opinion that the disease is "of scrofulous origin;" but I have reason to believe he has now a different impression.

Is the fungus disease known in the Bengal Presidency? The answer must yet be in the negative; but it is highly probable that attention now being drawn to the subject, its occurrence there will be established. The case recorded in the Indian Annals,

vol. ii. p. 706, may have been of this nature—an instance of what I shall call the *first variety*. Dark granular matter, or black gritty particles, were found amongst the bones and in the sinuses—precisely the positions that the black fungus particles occupy.*

I now come to one of the most important accounts of the affection hitherto pubished. It is a paper by my colleague, Dr. G. R. Ballingall, in the 2nd vol. (New Series) of the Transactions of the Medical and Physical Society of Bombay, entitled "*An account of a tumour affecting the foot*," and it contains the first notice of the microscopic peculiarities of the disease. A concise description of the external characters (as seen at Bombay), with a reference to the peculiar discharge from the sinuses, is followed by that of a sectional surface. The pulpy granular substance found in the internal parts, and occasionally in the discharge, is then microscopically examined, and seen to be composed of large granular cells, circular or oval, and generally surrounded with transparent fringes consisting of large irregular spiculæ; radiating groups of spiculæ without any distinct cell in the centre, and numerous oil globules may be also detected. The nature of these bodies could not be made out; they were considered to be organized structures, and the disease to be essentially of a parasitic nature, the new growth gradually taking the place of the normal bony structure, which is probably removed by absorption. Other remarks follow, and an illustration is appended. It is thus seen that Dr. Ballingall was led by his sagacity to distinguish this tumour at sight from a simple scrofulous affection, and to detect the prominent peculiarities of the new-formed deposit. No reference is made to that variety of the disease in which the more striking *black* fungus is found; indeed,

* It was presumed, after a microscopic examination of this matter, that it was dried blood only; but it is important to remark that the structure of fungi is difficult to investigate, or, to one impressed with some other idea, even to detect.

Two cases of scrofulous disease of the foot are recorded in the same journal, Annals, vol. iv., p. 643, the first of which appears to have presented in external appearance many similarities to cases of this disease.

Dr. Eyre (*loc. cit. post*) could not find notices of any similar disease in the Records of the Bengal Dispensaries.

(The answer to the above query must now be in the affirmative.—*See Appendix A.* —*H. V. C.*)

I may say, that until the case occurred which I shall describe by-and-by, no other appears to have been seen at the Jamsetjee Jejeebhoy Hospital, as in the long experience of the present Principal, Dr. Peet, no similar instance can be recalled to mind.

I have examined the preserved specimens in the College, and can confirm most of Dr. Ballingall's statements. As will be seen hereafter, the true nature of the bodies is as follows :—the large granular cell is the remains of an altered fungus—the spiculæ, and the radiating groups of crystals are of a fatty nature, the abundance of oil globules also indicating the presence of these principles. A congeries of the fungus particles and crystals forms the yellow granules found in the discharge, and, on after-examination, in the sinuses and cavities of the diseased parts. It is not to be wondered at that even Professor Queckett should not have been able to detect the real nature of the large granular "cells," as at this stage their characteristic structure is lost. The fungi having died and degenerated, become the nucleus of crystallization, their own structure also probably furnishing fatty crystalline principles; for, like the nitrogenous animal matter, the nitrogenous material of these fungi seems to be capable of fatty degeneration.*

In the last volume of these Transactions (vol. v., New Series, p. 230), several "*cases of diseased foot*" are recorded by Sub-Assistant Surgeon Bazunjee Rustomjee, in Medical charge of the Bhooj Dispensary; they relate to a disease peculiar to certain parts of the Bombay Presidency, &c., and being the most fully and carefully recorded instances of the *fungus disease* yet published, are well deserving of perusal by all interested in this subject. The cases are eight in number: subsequently Mr. Bazunjee Rustomjee has forwarded others to Bombay, and he had at that time seen four or five more, so that the frequency of the affection in Kutch, &c., may be considered well-established. I have myself received undoubted specimens from the same localities—including one very characteristic of the black variety of fungus-growth, from Mr. Sudasew Hemraz formerly Sub-Assistant Surgeon.

* There are appearances in the degenerating fungi which have induced me to make this observation. I have seen oil globules escape from their interior.

Most of the instances now referred to belong to the second variety, the small, soft, yellowish granules being present; but the writer briefly distinguishes another form in which the granular deposit is absent, and a substance "dark in colour, and soft and thick in consistence" is substituted. He supplies us with a summary of the symptoms, pathology, and morbid anatomy, which is very creditable to his care and discernment. Practically the disease is regarded as a species of caries peculiar to India: the connection with *phthisis pulmonalis* is disallowed, and I think correctly; the nature of the deposit is considered scrofulous, or allied to it. I shall have occasion to refer to these interesting cases further on.

Perhaps the most complete account of this affection is, however, to be found in a late number of the Indian Annals, No. XII., July 1859, published April 10th, 1860.*

Dr. E. W. Eyre, of the Madras Medical service, the author of the paper referred to, entitles it "*Account of a peculiar disease (tubercular) of the foot*," thus endorsing the opinion of Godfrey, his predecessor at Bellary. Dr. Eyre has himself seen 18 cases, and introduces an analysis of many others from Guntoor and Cuddappa. He refers to Godfrey's opinions, and then notices the disease under five heads:—

1. *The external characters*, briefly describing them, and adding a coloured illustration, which (however inferior to the original drawing, as I am informed by Dr. Eyre it is) is quite characteristic. 2. *The previous history* and natural course of the disease, the absence of constitutional taint and natural termination by diarrhœa (as in other exhausting affections) are noted, *inter alia*. 3. *The morbid anatomy*.—Dr. Eyre states that, although various appearances may be seen in different cases, yet they but indicate different stages of the same process. "In every foot examined were numerous minute tubercles, resembling fish-roe, lying beneath the muscles and extending from the bones to beneath the skin, and nodules composed of the same, often black in colour." A minute account of the dissection of two

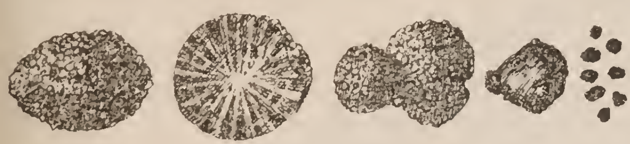
* This number did not reach Bombay till upwards of two months after the communication which forms the basis of the present article had been read before the Society, and a brief summary of it printed and circulated.

specimens is added; for want of a clue to the actual nature of the disease, all bare descriptions must be obscure, but we may recognize all the main features of the *fungus disease* in that here given by Assistant Surgeon Day. 4. *What is the disease?*—The author is evidently inclined to look upon the disease as of a strumous nature, and quotes cases, &c., which appear to resemble his, and which were decidedly so: although it is distinctly stated that no diathesis or hereditary taint is present in these Indian cases. Through Dr. Eyre's great civility, I am enabled to state that the disease is not, in his opinion, of a true tubercular nature; he remarks to me, in a private communication, that he gave it a doubtful appellation when he termed it tubercular. The conclusions of such an experienced observer are of great importance in considering this part of the subject, I wish therefore to be somewhat particular in freeing the word "tubercular" from a meaning it might very readily be supposed to bear. Were the little granules really scrofulous deposits, the term would be strictly applicable; but then we should probably find them associated with the well-known diathesis, &c. This is not the case: hence the word now used is not quite appropriate. 5. *The results of treatment.*—On this point the author's facts and statements must be considered as authoritative. Amputation is the only cure,—it is a radical cure; no case of return of the disease appears to have been recorded, and the risk of operation is even below the average. Other remarks follow, and the author concludes thus, "the utility of the Civil Dispensaries receives an additional testimony from this one disease. The natural course of it being fatal, 60 lives have been saved in this and the Guntoor districts, by the surgical means afforded at the Dispensaries." I am glad to find that, as far as the medical history, &c., of the disease is concerned, the conclusions I had come to coincide with those enunciated by Dr. Eyre, whose long experience has made him an authority. The real nature of the affection, however, is, I am convinced, now first brought to light; the result of prolonged observation leaves no question in my mind on this part of the subject.

In addition to the published information thus summed up, I have to refer to additional sources in communications from

FUNGUS-DISEASE OF THE FOOT (FIRST VARIETY).

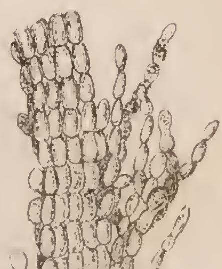
A vertical section of the Foot.



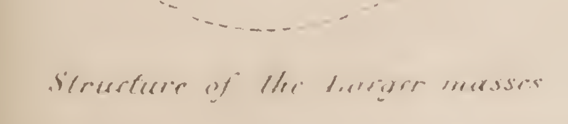
Actual size and form of the Fungus-masses.

Structure of the Larger masses

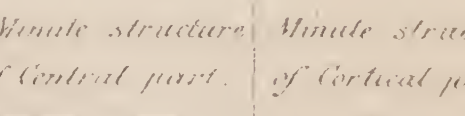
Minute structure of Central part.



Minute structure of Cortical part



Enlarged view of the Smaller ones



Spores - magnified.

H.V. Carter, del et lith

B.E.S. Press

CASE I. *External view of the bones of the ankle-joint, affected with Fungus-disease: showing the peculiar spherical cavities which lodge the Fungus-masses.*

a Tibia.

b Fibula.

c Astragalus.

d Os Calcis

B.E.S. Press

Dr. Colebrook, late Civil Surgeon at Madurà; Dr. Day of Cochin, who kindly forwarded me two photographs of bones affected with the fungus disease, in which its characteristics, as pointed out further on, may be readily seen; Dr. R. Wilson, now of Madura, who obligingly forwarded two sets of specimens and notes to Bombay; Dr. Bidie of Guntoor; Dr. Asher of Hydrabad (Scinde): and lastly to Dr. Eyre by whose kind efforts two fine specimens of the disease have been sent here. To Dr. Cornish, Madras Medical Service, I am particularly indebted, as he voluntarily undertook to use the influence of his official position in obtaining specimens and information for the elucidation of this singular disease. Sub-Assistant Surgeon Bazunjee Rustomjee and Mr. Sudasew Hemraz (now Physician to the Rao of Kutch), Graduates of the Grant Medical College, have obligingly favoured me with interesting information and specimens, which have been fully made use of. The experience of the J. J. Hospital has, however, furnished the typical cases which gave the clue to the actual nature of the disease; that of the woman, narrated further on, is the only one of the kind I have yet seen, and without the knowledge obtained thence, the obscurity concerning the particles, granules, or tubercles, might still have prevailed. The black variety of fungus was also first found in a specimen from the same source.

Description of Cases and Specimens.

I consider this disease to present at least two varieties. The first case that presented itself is as follows:—

First Variety.

No. 1.—Pandoo, Hindoo, aged about 35 years; farmer or cultivator of grain by occupation; residence about 15 koss from Poona, in the Deccan. Admitted in the J. J. Hospital, September 21st, 1859. His right foot is much enlarged, particularly about the ankle: the general form of the swelling is oval, and somewhat resembling that of extensive scrofulous caries of the part; the skin is thrown into coarse corrugated wrinkles. On either side of the ankle-joint, and on the dorsum of the foot, near the toes, and also in the sole, at this part, are numerous small soft swellings or tubercles as large as a pea, or marble, having puckered apertures, or fistulous openings connected with them; and at these points the skin appears lighter in colour than elsewhere. The tubercles may be seen in all stages—from a slight elevation of the surface to an accuminated point, and there a puckered fistulous

orifice appears. They are most numerous about the ankle, particularly the outer, where nine or ten may be counted, and on the dorsum of the toes there are nearly as many; some of the spots appear as if cicatrized. On introducing a probe into one of these apertures, a long but not tortuous sinus is entered, which frequently leads to neighbouring bone, but not always. A discoloured glairy sero-purulent fluid exudes on pressure, and frequently a few black gritty particles. The discharge is not like the thin curdy pus of a scrofulous abscess. The toes are distorted, and displaced upwards, and the muscles of the calf of the leg are atrophied. The patient is emaciated and cachectic; he has never had syphilis. The disease is of 12 years standing, and its history is as follows. When wading in a nulla, a thorn stuck in the sole of the foot, bleeding followed, and an abscess formed, the size of a walnut. The swelling began to spread, without much pain, from the sole of the foot and toes, towards the ankle, which became implicated only a year since; amputation of the leg was performed by Mr. W. G. Hunter, October 3rd, 1859, and the patient made a slow but complete recovery.

The appearances thus detailed appear to be peculiar to this disease, although the swelling and imbedding of the toes are frequently much more marked. The amputated member was examined by me within two hours after removal, and the appearance of the section I made a coloured drawing of at the time. It needed but a glance to see that the characteristics of the disease were numerous black masses studded throughout both hard and soft parts.

The lower end of the *tibia* has imbedded in its cancellous tissue two isolated and spherical masses, the size of a marble and of the darkest pigmentary hue. The anterior portion of the *os calcis* is occupied by a still larger and more irregular mass, composed in part of smaller black spherical masses, and also of a fleshy substance intermixed. Beneath the skin, at the fore part of the dorsum of the foot, are numerous, round, dark-coloured tubercles, which are seen to be composed of black spherical particles, aggregated together. The extensor tendons of the toes have been displaced, and consequently the toes themselves, by this collection. Beneath the first phalanx, and heads of the metatarsal bones are other masses of the same appearance, and before and behind the ankle-joint are also fleshy masses dark with pigment. All the other tissues and parts exhibit a normal appearance, for there is little of that elephantiasis-like thickening of the skin which frequently co-exists with the fungus growth. There is no deposit in the cancelli of the bones or that blending of the parts that one observes in cancer; the black masses may be picked out quite clean, and appear to be inclosed in a membrane which lines the cavity or space they are contained in. The articulations are neither inflamed nor ulcerated. There is no caries; the osseous tissue having been removed by mere absorption.

Several of the black bullet-like masses were removed and are now preserved in a dry and moist state, retaining in the latter condition their first appearance and structure. The bones were macerated and are now in the Grant College Museum.

The minute examination of the fungus will be found further on.

No. 2.—In February 1860, I received from Bhooj, in Kutch, an entire foot, which was kindly forwarded by Mr. Sudasew Hemraz, Physician to the Rao of Kutch. No history of the case reached me; but the specimen turned out to be very similar indeed to that above described. Having received further information from Mr. Sudasew Hemraz, I am led to suppose that the present specimen was but a type of the cases commonly occurring in Kutch; he would doubtless have mentioned peculiarities. The whole foot has the globular shape characteristic of these cases. There are several apertures placed on the dorsum and on either side of the ankle and foot, but none in the sole; they are like those of the first specimen, and some are occupied by little black grains identical with the particles forming the deposits in the interior, to be afterwards described. White patches are scattered around these apertures: the toes are distorted upwards, as before. A coloured sketch was made at once and then a median vertical section, which is figured (See Plate 1).

The *tibia* (and probably the *fibula*) are seen to be free from black deposit in this case, but there is a thinning of the walls of the shaft, and a softened spot placed in a part which is whiter in colour than the rest of the cancellous tissue, but of the same density; the softened spot has the same white colour, and it looks as if fat had been deposited there. Also in the *os calcis* just behind the place of the bursa mucosa of the tendo-Achillis the osseous tissue is softened somewhat, but not changed in colour. On careful examination of these parts, only a large increase of fat-cells, crystals of stearine (external and internal), and the remains of the medullary membrane, studded with granular nuclei, were found; no fungus-particles were detected. The *astragulus* is unaffected. In the fore-part of the *os calcis* is a black or sooty mass, granular and firm, and having the characteristic spherical or lobulated form, it is the size of a sooparee nut. The *cuneiform* bones are occupied by a larger deposit of similar appearance, and beneath the thickened integument covering them, and also partially blended with the former mass are seen two round black deposits like large peas; also a third a little further back; and again in the soft parts beneath these bones in the sole of the foot are two other masses of similar appearance; smaller deposits are seen beneath the toes in front. The integument is thickened, as in elephantiasis, on the dorsum of the foot; and there appears to have been some fibrous thickening amongst the parts in the sole. The joints are unaffected. The osseous tissue is mostly normal, and only absorbed when the black masses have been deposited; the cavities containing these are of the usual

spherical form. As for the fungus masses, compared with those of the first specimen, they are somewhat less firm and regular when enucleated, but in all other respects identical with them. In some cases, as those from the cavity in the *os cuneiform*, the mass is soft, friable, and very readily splits up into radii diverging from the centre, having the same consistence as rotted wood; there is no difference in their colour, and similar masses were found in No. 1.

The microscopical characters of both specimens will be given in a general description of this fungus further on. A portion of this foot is preserved in the Grant Medical College, and one half was sent to England, for exhibition to the Pathological Society of London in May 1860.

No. 3. A third and very interesting specimen of this disease was forwarded to the College by Dr. Asher, Civil Surgeon at Hydrabad, in Sind.* I have not had time to fully examine this foot, but need only now state that it almost, if not quite, demonstrates the way in which this variety of the fungus disease commences (see page 138). Dr. Asher's note is as follows:—

"Foot of a prisoner in Hydrabad Jail; amputated 31st October 1860. Disease commenced in the sole of the foot, by the appearance of a tubular indolent swelling, at the end of 1856, attributable to no known cause. He previously enjoyed good health. Similar swellings gradually extended over the whole foot, and here and there, circumscribed suppuration took place, giving rise to breaches of surface, and these, remaining open, took on the appearance of papillæ, from which there came a scanty thin discharge. A deep aching in the foot was merely felt, there being no acute pain at any period of the disease. Progression up to the date of amputation was merely incommoded by the weight of the foot; and for a considerable time previous to the operation the man was in weak health, and much emaciated."

No brief account could better have summed up many of the chief features of this disease: the black particles, if not actually discharged, must have been very close to the surface of the skin, as they were found there afterwards.

General form is striking and characteristic; the swelling, of considerable size, involved the whole foot, and is particularly large about the ankle-joint; the toes are quite distinct. A large number of apertures are scattered over the surface, several being on the sole of the foot: they have the usual pouting appearance.

* Dr. Niven of Kotree was kind enough to advertise me of its despatch, and to forward the history of the case written by Dr. Asher. For other remarks on the history of this case, since forwarded to me, see Appendix B.

FUNGUS DISEASE OF THE FOOT. (SECOND VARIETY)

FUNGI. *from the foot of the woman ... see Case 1*

"MADURA FOOT" – *Diagram of part of a section –*
The Fungi, are the dots in the shaded portion.

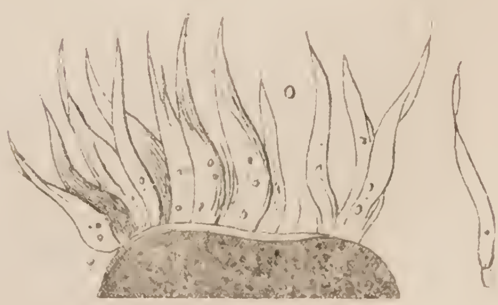
FUNGI *magnified*

Madura Spec.

Isolated Fat crystals.

FUNGI *with crystaline coat*

Bellary Spec.



A portion highly magnified

B. T. S. Cross

H. V. Carter, ad. et lith.

Section.—The small bones and soft parts are indistinct on account of the growth of a dark-coloured fleshy substance, imbedded in which are the black fungi. *Tibia*—in the cancellous tissue of its lower extremity are one or more collections of black particles—in the *os calcis* others; there being the usual spherical cavities in these bones as well as in others that are affected. The amount of parasitic development is very considerable, and was, I think rapidly increasing at the time of amputation.

As regards *minute structure* there appears little that is peculiar, the similarity of this fungus to the last described is in most respects complete.

No. 4. Another specimen of this variety of the disease is in my possession. It was presented by the Secretary of the Medical and Physical Society, on the part of some unknown donor, and is a fragment mounted in a bottle labelled "Tumour from which Podelkoma originates:"—here is a new name, and not unlikely that of an independent and discerning observer.

Second Variety.

The following cases present examples of what may be considered another variety of the fungus disease. Different as the specimens appear to be, particularly in the absence of the black masses, yet the external appearances are not unlike, the bones are affected in a similar way, and a fungus is to be found, as in the first case; hence I call these cases varieties only.

No. 1.—A Hindoo woman æt. 50, inhabitant of Gogo, was admitted into the J. J. Hospital, in the middle of November 1859. The left foot is affected, and there is the same swelling, and similar soft tubercles (only larger in size) connected with it, about the ankle joint, and on the dorsum of the foot. The toes are not distorted as in the first specimen. Many of the tubercles appear to have opened, and were discharging a thin watery fluid, or occasionally pus; when minutely examined, besides numerous pus globules, several small white masses are found in the discharge (*fungi*); a probe readily passes down some way into the tissues of the foot. The patient is emaciated, and states that 4 years ago she was salivated at the Rajcote Dispensary. The history of the case is as follows:—seven or eight years ago she struck the inner part of the foot against a door: an abscess followed, which she opened with a needle: it did not heal but re-appeared several times, when it was frequently opened by means of a thorn. Two or three years subsequently to this, the disease spread gradually, and fistulous openings began to appear. The leg was amputated November 30th, 1859, by Dr. Ballingall, and the patient recovered. Drawings were made of the external and sectional appearances of this specimen. In this case, the diseased parts consisted of collections of what looked like sloughing tissue; grey or blackish masses,

almost glairy in consistence and accumulated in loculi from which they could be readily drawn out, whether in the soft parts or in the bones, which were excavated to receive them. The principal accumulations were behind the *tendo-Achillis*, encroaching on the bones just above the *os calcis*, also in front of the ankle-joint occupying the position of the anterior part of the *astragalus* which has here been partly absorbed, and also accumulated beneath the skin. In the arch of the sole of the foot, too, is another group of these soft masses encroaching on the front part of the *os calcis*, and communicating with the last-mentioned mass. On the whole, the bones, were somewhat less affected than in the preceding specimens. The lower end of the *tibia* did not contain any of the foreign substance, but the cancellous tissue was a little softened, two small spherical cavities being half excavated in the bone: its walls were thickened and "rarified." No black granules were seen; and only after a careful examination were white granules detected in the interior of the loculi; some were semi-transparent, and others opaque like those found in the specimens referred to by Dr. Ballingall, and contained in our museum. One half of this foot is preserved in a moist state, and one half has been macerated to show the extent of disease in the bones. The discharge from the sinuses on the foot was, prior to the operation, examined with the microscope. It was thin, watery, like diluted pus, irregularly opaque, but no masses at once distinct to the unaided eye were seen. There were pus and blood corpuscules and granule cells. There were numerous small bodies barely visible as white dots to the eye, but looked at when magnified, of a rounded tuberculated form, yellowish in tint, and varying a little in size. These are the *fungi* in this variety of the disease; and there must have been dozens, or even hundreds of them daily discharged from the foot. They were abundantly found in the diseased growth, and will be more fully described when the general account is given further on.

It is worthy of notice that the nature of this disease was detected before amputation was performed (See Plate 2).

No. 2.—A specimen was forwarded me from Kurrachee by Sub-Assistant Surgeon Bazunjee Rustomjee. The case is recorded in Transactions Bombay Medical and Physical Society, vol. v, p. 239. There is a part of the foot including the heel; the outer surface present depressed openings like cicatrices and white patches. The former led down through thickened integument to cavities in the bones precisely resembling those of other specimens. In front of the ankle-joint there seems to have been the greatest collection of the growth, no white granules were to be detected in the hollow cavity of the bones (having probably been all discharged prior to amputation), but a few bunches of radiated crystals.

No. 3. Kindly forwarded by Dr. R. Wilson from Madura, June 28th, 1860. This gentleman in his communication to me, states that he considers the case and specimen as good illustrations of the Madura tuberculated foot.

Patient, a woman about 26 years of age, disease said to be of about 4 years standing. She is the wife of a ryot, and has frequently been employed in field labour, in cotton soil, and amongst cotton plants; she does not remember having received any injury on the foot. The disease first commenced as a boil on the dorsum, and under native remedies it gradually merged into its present condition, when she applied at the Civil Hospital, Madura, for relief.

The specimen arrived in Bombay, July 21st, and may be described as follows :—

External appearance.—The whole foot is enormously enlarged, and appears, as it were, spread out, or flattened; hence the resemblance to the former cases, as to general form, is not great, but taken altogether the foot presents a most striking appearance. It is not enlarged about the ankle-joint, so much as towards the front part: it is everywhere enormously spread out, and thickened: and the soft parts beneath the toes are so affected, that the latter are imbedded and nearly hidden. Scattered over the dorsum of the foot, on the sides, and also in the sole, are numerous apertures, so characteristic of this affection. In their immediate neighbourhood, the skin is white, and frequently the white patches join. The openings are placed on small tubercles, or soft swellings, similar to those before described. The English Surgeon would find it difficult to place this specimen amongst local affections hitherto known to him.

Sectional appearance.—No distinction of parts evident on a glance; the small bones of the foot seem to be almost destroyed, leaving a paleish, slough-like tissue, or, as it is in front, reddish coloured and of similar consistence. The *tibia* is atrophied and softened, and the *astragalus* still more affected in the same way, and the other remaining *bones* are almost destroyed, being scooped out or excavated, as it were, on all sides by the new growth. *The soft parts* are also very obscurely indicated. The *skin* is hypertrophied; in it, the other soft parts, and in the bones, cylindrical tunnels, and spherical cavities, are to be seen, in which is imbedded the sloughy-looking tissue; this is very abundant towards the front, and, as stated before, of a pinkish colour. Fat is abundant, and oily matter exudes particularly from the bones.

The peculiar deposit in the canals just referred to is clearly the new growth; the canals join together or run towards the surface where they open at one of the sanious apertures described above. The fleshy tissue fills them in some parts, lines them in others, where large cavities are formed by the junction of several tunnels and here we meet with broken-up osseous tissue from the exposed bones around, grey fragments, and masses of pigment. The pink colour is partly owing to a general diffusion of pigment (tinging the oil globules, &c.), and partly to the presence of very numerous single or aggregated particles,

very minute (though distinct to the unaided eye), and scattered irregularly amongst the fleshy tissue. *These are the peculiar and characteristic fungus bodies.**

Miscroscopic examination.—The coloured particles seen under a low power presented a beautiful, rich pink *colour;* in *form,* rounded, oval, or four-sided, dumb-bell shaped, double, or even in a regular cluster of *four.* Very distinct particles were seen of the latter form, and one could not but infer that the four particles had been formed by the regular duplicate subdivision of one larger body. The double granules were also clearly the result of fission, so regular in both instances was the line of separation, and so similar the resulting separate segments.

Further investigation of these little bodies was attended with difficulties; separate or aggregate they have no cell wall, no nuclei exist in the interior: they are therefore not to be considered as large vegetable cells, or utricles, such as make up the mass or individuals, of confervoid plants otherwise the resemblance to *palmella,* would be noticeable. A prolonged examination of these high-coloured particles led to no satisfactory conclusion as to their actual structure. Where the splitting into two or four took place, one might see an appearance like that of broken ends of fungus-fibres, or it would seem as if the interior were filled with minute oval and rounded granules which escape by the rupture of the mass: the first supposition is the more likely. The matrix in which the particles were imbedded was loaded with fat, and had only an obscurely fibrous structure. Their size varied from $\frac{1}{50}$ to $\frac{1}{130}$ of an inch.

Examined at a later period many of the particles were found to be of a lighter colour, yellowish, or brownish, and it then became evident that these striking little bodies were precisely similar to the granules characteristic of the second variety of the fungus disease, and mentioned in the case of the woman just narrated (p. 115); so far their elucidation may be considered satisfactory. No trace of the first, or dark variety, of this

* When the sawn surfaces were first exposed to view, it appeared as if strewed with grains of red pepper; and I was induced to look on the articles close by me, to assure myself that there was here no accidental appearance, or that the red particles had not come from outside through the open window.

affection was detected, but it should be remarked that there was found in a larger cavity near the toes, freely opening on the skin, a large quantity of *débris* consisting of oily matter, epithelial scales, and even more than one *globe epidermique;* also dark masses which readily tore up, and in all probability were only altered *hairs,* in which the pigment had collected into separate granules. Future observers will not be misled by finding these irregular black fragments.

There were also seen globular clusters of crystalline spiculæ of considerable size, and forming small opaque, white-coloured masses visible to the eye. These have been detected in other cases of this disease (See Plate 2, for a diagram of the disposition of the fibrous growth and fungi, also an enlarged view of the latter).

As full descriptions of this disease are still a *desideratum* in Indian pathology, I shall add an account of two other preparations kindly forwarded from Bellary through Dr. Eyre; they were sent as "specimens," and were not accompanied by any history.

No. 1. *The smaller foot.*—Has the globular shape common to this disease; the swelling including the ankle and heel and the foot uniformly towards the toes, which are yet distinct and prominent. The skin is marked with large white patches. Numerous circular apertures and depressions may be seen scattered over the dorsum, sides, and heel of the foot: they are large enough to admit a pea or a shot, and are filled with a thin folded membrane which lines the tubes or sinuses into which they open. Small brown particles, like little seeds, may be seen in some of the apertures.

Section.—General indistinctness of parts. The surface is studded with round or oval holes in which are lodged brown particles, identical with those referred to above, or white and opaque granules of a similar form. In some places the colour of the particles is red, almost pink. The bones of the *tarsus,* especially the smaller ones, are hollowed into spherical cavities to receive these bodies. The osseous tissue is not itself diseased; that of the *astragalus* and *os calcis* is, if anything, somewhat hardened. The tibia is unaffected, except that the cancellous tissue appears coarser than usual. The soft parts are enlarged and thickened by the formation of fibrous tissue, and they are almost everywhere permeated by canals and cavities filled with the brown particles; this appearance extends as high as 4 inches above the ankle-joint behind the tibia, or, it may be quite up to the line of operation (about 5 inches). Deposits of the same brown granules may be seen just beneath the skin, or filling the tubes which lead from the

apertures on the surface down to the cavities and canals in the interior. There is a greenish, oily, sloughy appearance of the soft parts beneath the skin, and running up the leg: this is owing to the disorganization produced by the disease. *The fungus-particles* are generally of a mahogany-brown colour, but may be bright pink, or dirty yellow, or even paler; some appear to have been transformed into white opaque granules. They attract attention when the section is first exposed to view, and are *exceedingly* numerous. Their consistence is firm and friable, almost brittle, and uniform throughout. The *larger* ones are the size of small peas, and tuberculated on the surface: they readily break up into segments along the radii, and are clearly not mere aggregations of small particles. In other respects they resemble the larger black fungi before described, and may be regarded as having had the same structure originally: the colour only varying. The *smaller* ones are also similar in form and size to the small black fungi, showing even the same appearance of a pedicle: the colour and consistence, however, being very different. As to their *minute structure,* in by far the great majority of cases, the fungus structure has become almost obliterated: a radiating fibrous disposition is, however, clearly apparent, and one may see separate delicate clear fibres. The different consistence of the particles when compared with the black granules, which were rather *tough,* shows that they have undergone some change, it may be a degeneration. The same appearances are found throughout, but I reserve further remarks till a more thorough examination has been made.

The white granules are wholly formed of delicate radiating crystalline spiculæ, and are evidently of inorganic structure; they may or may not have been produced by the *total* degeneration of fungus particles: crystalline fatty particles having taken their place.

2. *The large foot.*—It is much more misshapen than the last specimen, presenting a most characteristic appearance totally unlike any comparable affection I have ever seen in Europe. The anterior half of the foot is enormously expanded and thickened: only the outer and inner toes are visible; the others being imbedded in the new growth: the greatest circumference at this part is 16 inches. The surface is riddled with round holes, like those of the last specimen, only more numerous and various in size. They lead down to the same canals and cavities which are also filled with granular masses. The individual particles are perfectly distinct to the unaided eye, and resemble those found in the College and other specimens. Some are pink, other brown or whitish. The total number must be immense; and as each particle contains dozens of *fungi,* and each granular mass as many separate particles, we may reckon the former by millions.

A small granule examined microscopically was found to be made up of *fungus particles* invested with the peculiar *radiating crystalline coat* which is now well known, having been first described by Dr. Ballingall. Caustic soda destroys the structure of, and partially dissolves, the crystals, and the fungi

become clear, with the exception of an occasional appearance like that of a membrane round them, they are identical with those of the College specimens. The fungus structure is not apparent.*

There are in the Museum, Grant Medical College, mounted specimens, and also in the dissecting room some others, which are examples of the second variety of the fungus disease. The external appearance of all resembles that of the specimens I have now described, and I may say the bones are affected in a precisely similar manner, which I shall presently describe,—hence we may consider these older instances, and my own, to be of the same kind.

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* The following case and notes may be added: A Hindoo grass-seller, æt. 35, native of Rutnagherry, was a patient in the J. J. Hospital, July 1851. The right foot is swollen to double its natural size, the swelling is in many places soft and elastic, in others hard and tumid. The toes appear shortened as if imbedded in the swelling. The skin of the foot is terse, shining, and somewhat discoloured. There are numerous small openings situated over elevated bases, through which a thin sanious discharge oozes. About 3 years ago, the sole of the foot was pierced by a thorn, abscesses and swelling followed, and he was salivated: hectic symptoms came on, and the leg was amputated, the man recovering. It does not appear from the history of the case that " the man suffered from syphilis, or manifested any symptoms of " scrofula."—*From the Transactions of the Medical and Physical Society of Bombay, Vol. II., New Series, p.* 337. *By Mr. J. C. Lisboa.*

The presence of granules in the discharge is not mentioned, but no doubt they were there: the bones were affected as follows:—

The lower extremities of the *tibia* and *fibula* present, specially the latter, appearances of chronic periostitis. At the place of the lower tibia fibular articulation is a small deep cavity, and a shallower one on the *fibula* indicating the commencement of absorption. The articular cartilages are healthy. All the bones of the *tarsus* and the adjoining ends of the *metatarsal bones*, and even one or two of the *phalanges* have been implicated in the disease with the exception of the *astragulus* (upper or articular surface): they are perforated in all directions by numerous small spherical cavities large enough to lodge a pea or bean, or even a little larger.

The reticulated or areolar appearance thus produced is equally apparent in the sole and dorsum of the foot. The sides and solar surface of the os-calcis present several of these cavities opening outwards, by rounded apertures, and communicating by tubular passages. The head of the astragalus is the part principally affected. All the smaller tarsal bones, bases of metatarsal bones, and their heads and adjoining phalanges in the case of the 1st and 2nd toes are also similarly affected. The osseous substance in all these parts is diminished by absorption and atrophy, and marked in a few places by new periosteal deposits, but otherwise the texture is healthy in density and colour. See A 62, Grant College Museum.

Changes produced in the Bones (*See plate* 3).

These have been referred to by almost every writer since the time of Godfrey, but there is no account printed, as far as I know, which would afford to one unacquainted with this disease a definite and satisfactory idea of its peculiarities in this respect; such terms as "worm-eaten" or "honey-combed" "irregular cavities" do not convey either a distinct or accurate impression.

The three macerated specimens I have before me are strikingly different from any others of diseased bones, that I have ever seen; indeed a very short examination of them leads one almost irresistably to the conclusion that some *organic* agency has been at work to produce these changes. I may say that the moist specimens too, sufficiently indicate a markedly similar state of the bony parts implicated. Knowing the common features of all, it is, to my mind, quite easy to detect them in the two photographs of dried preparations which Mr. Day, of Cochin, has been kind enough to forward me, and in this way the identity of the fungus-disease in the Bombay and Madras Presidencies may be established.

The cancellated tissue of the *tibia* and *fibula* at their lower extremities, of any or all of the *tarsal* bones, and even of the *metatarsal* bones and *phalanges* of the toes, is the seat of cavities more or less spherical, and sometimes most perfectly so, which vary in size from a little more than that of a pin's head, to that of a round bullet, and whose walls are formed by open cancellous tissue. From being in close juxta-position they frequently open into each other, producing larger vaulted gaps, or cavities: and not only so, but every cavity, large or small, has an open communication directly or indirectly with the external surface. In the more superficial ones, some part of the parieties is wanting, so that the cavities look like mere round holes of various depths; but in the deeper placed, a regular tunnel, more generally straight than curved, serves as the channel of communication. The diameter of these passages varies, being sometimes equal to that of the cavities themselves. In the recent state, the sinuses of the soft parts, when they do not end in the superficial collections of fungi, lead down to these tunnelled passages,

or into the rounded holes. Now, the cavities above described are the "loci" of the "fungus :" the tendency of the latter to acquire a regular spherical form was plainly seen in the specimens of the *first* variety of the disease to have eventually caused the excavation of these cavities, and it is so in the *second* variety, be that another stage or not of the first, since in it, the white granules may be seen to be aggregated, in many cases, into a globular mulberry-like mass, lodged in the same cavities. The osseous tissue appears to be generally healthy in texture, and only acted upon by the mere pressure of these new growths, or a little "rarified" as if from increased vascularity. Sometimes, however (as stated in case, p. 113.), softened spots are found apparently unconnected with the presence of a fungus mass, which assumed a spherical form on drying; in the case just referred to, these cavities are best seen in the tibia, and have two or three small tunnelled passages leading to the exterior. Now, it must be noted in this instance, that not a particle of pus, or anything like strumous deposit was contained in the cavities, these appeared to be only an accumulation of fatty matter, but it is probable that fungi had been there, and either been expelled, or had undergone a fatty change.*

In no other case are any of the appearances of caries or softening, independent of the characteristic cavities, to be seen.

Changes in the *periosteum* of the bones of the leg, and larger

* I was informed by Assistant Surgeon Stedman, late Civil Surgeon at Hydrabad, that he had there seen a case which would appear to have been one of the first variety of this disease ; black masses, and tunnelling of the bones being present, but there was also softening of the cancellous tissue, in parts. It should be remembered, I think, that this may occur from either thinning as produced by mere pressure, or from simple increased vascularity, also induced by the irritating presence of a foreign body ; without there being in either case a strumous or cancerous deposit in the cancelli, or their lining membrane. In the two former cases, the cancelli will either remain of their normal size (as occurs in this disease), or if they be expanded, other very manifest signs of increased vascularity, as the presence of large vascular apertures, roughening of the surface, &c., would be seen. In cancer or struma, there would be an actual visible deposit, and with the expansion of the cancelli, such characteristic vascular marks, as are above indicated, might or might not be present. It may be thought that circumscribed abscess of bone would simulate these appearances, but a little reflection would suffice to prevent confusion. Mr. Stedman considered that cases of "foot disease" were not uncommon in Hydrabad and its neighbourhood. Dr. Asher corroborates this opinion.

tarsal bones, generally co-exist. The presence of the fungus induces a chronic inflammatory process; and great roughening of the surface, expansion of the compact tissue, and throwing out of osseous spiculæ, often in abundance, are the consequence. These alterations are not characteristic of any disease, but occur invariably under certain circumstances; they mask, however, the peculiarities, and it is necessary their true nature should be known.

I have before stated that the *articulations* of the part are never primarily affected, but like the osseous tissue itself, only in a secondary or indirect way: that is, by mere pressure, or perhaps by simply increased vascularity caused by the presence of a foreign body. In parts, the edge of the articular cartilage may be seen to be quite clear and straight, when a "cavity" happens to have been formed across a joint.

In conclusion, it will be found, in recent specimens, that the cavities and tunnels are closely lined by an easily separated membrane, continuous with the external surface of the part; where, commencing at the skin, it starts like a funnel-shaped tube dipping downwards towards them. In this way, it is probable, the contents of the cavities are conducted to the surface, and then expelled.

Proofs and Evidences of the true nature of the Disease, as derived from Structure, Comparison, and Analogy.

The nomenclature of the "fungus disease" is so varied that it is clear no uniform impression of its true character has ever prevailed amongst observers; such names, such definitions as the following have been employed, "Fibro-cartilaginous:" "Tubercular disease:" "Hypertrophy with disease of the bones:" "Caries:" "A peculiar disease:" "Podelkoma," &c. &c. In adding one more to the list, I feel there is both need and cause for it, trusting that by-and-by it may be looked upon as the more correct (even if less euphonious) designation.

The best proof of the actual nature of the disease is derived from its anatomy or structure; and the following characters may be enumerated as forming this proof.

External appearances.—Globular, or flattened form of swelling, often very considerable; never extending above the foot, it may be occupying only a part of it. Skin first studded with blebs or soft tubercles, marked with very numerous sinuous apertures, raised on the tubercles, or not. A thin discharge, often scanty and watery, and generally containing small granules or particles, either barely visible, or distinct, soft, and like to poppy seeds, or black in colour.

Sectional appearance.—General confusion of parts, owing to absorption of the bones, and fibrous thickening of the soft parts, both however occurring after some degree of method. Often the presence of granules, separate, or aggregated in mulberry-like masses of a yellow or brown colour; lodged in spherical cavities, excavated in the bones or soft parts, or in tunnels or channels leading from these cavities to the apertures on the surface, and also lined with a membrane: these granules are present in the discharge.

Sometimes there is a deposit of a fleshy (may be reddish or dark-coloured) substance, containing numerous minute particles (white or red) and occupying the same localities as the above-mentioned granular deposit. Lastly, in the same cavities and tunnels, we may find black granules; spheroidal, tuberculated masses of the same colour, and radiated in structure, which have been mistaken for melanosis, or blood clots.

At present I know of no other disease presenting an assemblage of these characters; when detected, the nature of the affection is at once apparent. At a very early stage some care may be requisite in forming a diagnosis.

Tubercular or articular leprosy, elephantiasis, caries, strumous disease, malignant affections, or a combination of one or more of these diseases, may be enumerated as being most likely to be mistaken for fungus disease, but it can be hardly necessary to do more than very briefly point out how they differ in appearance and structural change.

In *Leprosy* (tuberculosa, or articulorum), the foot wants the above external characters: there is a progressive destruction of the parts by wasting or ulceration, or both; gene-

rally beginning with the toes ; frequently numbness of the skin : very often the other foot is symmetrically affected, or the hands, &c.

In *Elephantiasis,* the above-named appearances are mostly wanting, the foot being more uniformly affected, and rather *puffy* at first ; the leg is afterwards implicated.

In *Caries,* the form of the swelling may be similar at first, but its size and shape never equal or resemble those of the advanced stage of fungus disease : the sinuses are less numerous : granules in the discharge are absent.*

Strumous disease is distinguishable in the same way as caries, there being generally present other complications or signs of the diathesis.

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* *Note.*—For the sake of comparison with the fungus disease, the following description of a foot affected with *caries,* which was amputated by me on September 13th, 1860, may be added. In almost every prominent particular, the distinction of the two diseases is obvious :—

Case.—A Portuguese æt. 27, caries of the left foot of seven years standing : no signs of scrofula : syphilis some years back : the local affection attributed to a sprain : emaciation, but no urgent constitutional depression.

Externally there is the absence of the peculiar distorted form of the foot, and also of the numerous openings, and small tubercles, which characterize the fungus disease. There are no white patches on the skin. The discharge is a thin, purulent fluid, in which no fungus particles are to be detected.

Section.—The bones appear loaded with oily matter, and there is increased vascularity of all parts. The cancelli of the former are filled with a deep yellow oily deposit, or else in parts occupied by a vascular, gelatinous, but firm substance, which invades the osseous tissue in no regular manner. The smaller tarsal bones are excavated by a large irregular cavity, with a vascular lining, like that of a common abscess.

The joints are specially affected, even when the bone beneath the articular surfaces is but little implicated by the carious deposit : the cartilages and ligaments are more or less destroyed, and covered with the well-known vascular membrane.

The cancellous tissue of the smaller bones is everywhere, and almost uniformly softened, having the thin layer of compact tissue as a mere shell.

A similar gelatinous deposit has invaded the periosteum of the lower end of the tibia, in front, producing much thickening : in the mass is a fragment of carious bone detached from the *astragalus.* This bone is anchylosed to the *os calcis,* which is roughened on its outer surface by numerous small pointed out-growths. The microscope shows the exudation cells forming the new deposit : and numerous capillaries. The muscles are healthy. When dried, the bones had none of the characters of this affection.

Malignant disease cannot, I think, be mistaken for this affection: the rapid growth, irregular swelling, absence of sinuses, &c., cachexia, &c., and many other signs would prevent the error.

In this very summary sketch only the external appearance is considered, for it alone is so characteristic that no reasonable doubt ought to exist, prior to operative procedure, if that be decided on. The appearance of a section, marked by the invariable presence of *fungi*, is even more characteristic.

In the following statement other features of the fungus disease are concisely noticed, and, as *compared* with other diseases, additional evidence is obtained of the foregoing conclusions.

Fungus disease.	*Other affections.*
Is endemic*	Hence differs from Cancer, Struma, &c.
Has a single local manifestation*	Hence differs from Cancer, Struma, Leprosy, &c.
Is much more frequent in men than in women*	Differs from Cancer, Struma, and to a less extent, from Leprosy, Elephantiasis.
And during the middle periods of life*	This is more marked than in Struma, Cancer, &c.
Is not hereditary*	Differs from all these affections.
Is not accompanied by fever*.	Differs from Elephantiasis.
Or constitutional taint*	Unlike Struma, Cancer, Leprosy, &c.
Is very protracted in duration.	Differs hence from Cancer.
Amputation is a cure	Not the case, in Cancer, Struma, Leprosy.

In those particulars marked by* this affection resembles the *animal* parasitic disease, dracunculus.

In addition to these imperfect remarks, it should be added that a syphilitic taint is even rarely associated with the fungus disease. I believe too, it may be admitted that the aching, wearing pains, hectic, starting pains, and most marked features of constitutional exhaustion, are less evident in this affection than in those of a constitutional nature: the patient complaining of the weight, inconvenience, &c., of the foot, and finally sinking by diarrhœa. White patches on the skin are not uncommon, as in leprosy.

Lastly, it is not pretended that the preceding observations are now first made; it is sufficiently apparent from the early part of this article, that many independent observers have looked upon the affection as unlike all others.

Proceeding thus by exclusion, it must be concluded that it is *sui generis;* and all I venture to affirm is, that its characteristic

and peculiar features, both in structure and clinical history, are best explained on the supposition that a foreign body enters the part, and developes there; which phenomena are perfectly adequate to account for the symptoms. That this should be a *vegetable* growth was certainly *not* to be expected; but the case of the *guinea-worm* is almost parallel, and furnishes the evidence derivable from *analogy*.

Many of the features above tabulated require a more detailed notice; this I proceed to furnish.

First, – the affection is *endemic*. Kutch, Kattiawar, Guzerat, Sind, the Deccan, Lower Concan, are known localities in this Presidency. Aden appears doubtful. On the Madras side, Guntoor, Bellary, Madura, Cuddapah, are well known localities: parts of Mysore, and, it is said, Trichinopoly (Dr. Neil). Whether it occurs in Bengal is doubtful:* the case before referred to was reported by a medical officer at Delhi. But it is not improbable that the affection will eventually be found to prevail in many other districts of India. That cases apparently similar, sometimes seen in Europe, are *identical*, cannot yet be maintained; keen observers are found in all countries, who must have, ere now, detected their nature. It will be enough to remind those interested in this subject, that *dracunculus* perfectly corresponds in this feature to the *vegetable* parasitic affection; the cases are on a parallel.

Second,—it has a *single local* manifestation. This is generally the right foot; but the left is almost equally liable to be affected. It is worth noticing that all Mr. Rustomjee Hormusjee's cases, and the majority of mine, were of the right foot; but a larger experience corrects this feature, as Dr. Eyre finds both feet about equally affected. Dr. Colebrook informs me, that, in the whole of his eleven years' experience (out of more than 80 cases), he has only once seen the disease in the hand. Both feet may be simultaneously implicated (Sub-Assistant Surgeon Bazunjee Rustomjee's case from Hydrabad in Sind, communicated). It is possible other parts of the body may be found to be the seat of this growth, but one can hardly help noticing how much more likely it is that the foot, of all others, should be affected, on the

* This is no longer so; see Appendix A.

supposition that the germs of a fungus, probably peculiar in its *habitat* to certain kinds of soil (cotton ?) find their way into the pores of the skin, or through some small wound, into the tissues. The presumption that such is the case appears as legitimate as that the ova of the *Guinea-worm* so find an entrance. In spite of its locomotive powers (which the fungus does not possess) this last is generally found in the foot, or lower limb: out of 210 cases, in 187 the worm, or worms, was in the foot (120), or between that and the knee (67); in but 3 out of the whole number was the worm in other locality alone than the lower extremity. (*Indian Annals*, No. XII, p. 481).

Third.—The fungus disease appears to be much more frequent in *men* than in *women*. In the range of my own knowledge there were 3 cases in women out of 16; and Colebrooke states, that only 3 women and 2 boys out of 75 cases, came under his notice. D. I. G. Eyre (*loc. cit.*) has also remarked this peculiarity—114 cases were males, and but 4 females. How is it with the guinea-worm disease? Very similar indeed: in 281 cases, Waring found 228 were males, and 53 were females. This proportion is considerably below what is stated above; but I shall have to observe in partial explanation that the occupation which appears to predispose males, is generally followed by them only.

As to *age*, judging from the few data at command here, it appears that patients are always above the age of puberty: from 17 to 50 is the range. Dr. Colebrooke tells me he had only 2 boys out of 75 cases: Dr. Eyre's tables and conclusions (the former giving a range of 20-60 years) are also confirmatory. It is probably a matter of accident that so few cases occur at an early period of life, but it is equally so that the disease occurs at all, for, as was observed under the last head, liability of exposure to the exciting cause determines the relative frequency of recurrence. It is much the same with *Dracunculus* 71·5 per cent. of cases occur beyond puberty (*Waring*).

As regards *occupation*, it is my own impression that the fungus disease will be found to be very prevalent amongst cultivators of the ground, or ryots: it appears to have been so here, and Eyre has noted the same fact. If it occur most frequently amongst them, and if there be no hereditary tendency (and this

no writer has attempted to show), the conclusion must be that they are most liable to the disease, or, as I should say, most exposed to the exciting cause; the fact not being overlooked that ryots form the greater proportion of inhabitants in most localities.

Last November (1859) I addressed a few questions to the Sub-Assistant Surgeons at Bhooj and Kurrachee, whose names I have had frequent occasion to mention; these with the answers are subjoined.

1. Is there any popular opinion prevalent as to its cause? Answers in the negative.*

2. Is the disease confined to certain localities remarkable in any way for kind of soil found, or cultivation practised? Answers do not indicate such peculiarity.†

3. Do members of the same family, or people living in the same house, get the disease at the same time?

Answers decidedly in the negative.

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* At Bellary the disease is known as "Ghootloo Mahdeo" from the tubercular irregularities being supposed to resemble eggs. (*Godfrey.*)

In Kutch, it is called "Kirudeo" probably from the number of openings on the foot, which give it the appearance of being eaten up by ants. (*B. Rustomjee.*)

† This question was put on account of an opinion supported by the experience of Drs. Ballingall and Colebrook, that residents on a *cotton soil* are peculiarly liable. Mr. Suddasew Hemraj states that he has "seen the disease in persons residing in all parts of Kutch, but it is more frequent to the East of Bhooj: it is a common belief in Kutch that the disease is more prevalent in the Wageer district than elsewhere." Mr. Bazunjee Rustomjee gives some details on the soil of Kutch generally, the salt marshes of the Run, &c., but does not indicate special localities. The Deccan patient mentioned above came from a cotton locality; but our data are insufficient to decide this question at present. The impression may turn out to be correct: but one would be inclined to believe, with Colebrook, that the puncture of a thorn (say of acacia) might be the exciting cause, or opening an abscess thus, might introduce spores. A small quantity of cotton soil was sent to me by Dr. Wilson of Madura last September; it was of a dark colour, and uniform granular consistence, formed of black friable mould intermixed with minute radicles, and small particles of quartz which have sometimes a reddish tinge: nothing was to be seen with a lens besides these. After exposure to air and moisture, no organic structure similar to either of the fungi now described could be detected; fungus filaments were seen, and a black substance, &c., but, as might have been anticipated from the different condition of things, the result was negative. I have since examined a similar specimen from Guntoor, with the same results.

4. Is there any ground for believing that the disease is introduced from without?

Answers contradictory.

It is well known as regards *Dracunculus* that it is more frequent at one season of the year than at others (*e. g.* in Bombay from May to August inclusive): the same peculiarity as to time of appearance is not yet made out regarding the fungus disease, whether it commences after the monsoon or during it, &c., perhaps future observers may find it so; but as natives have such indefinite notions of periods of time, it will be difficult to arrive at the truth.

The *duration* of the affection is always protracted; 2, 5, 10 or more years is the common range I think. Sub-Assistant Surgeon Sudasew Hemraj states, in his experience, the whole of the foot may become affected in some cases in two or three years, and in others not like 20 years, or even a longer period. D. I. G. Eyre also assigns a prolonged duration of 3, 5, 7, or more years. This period generally elapses before the patient presents himself, and then the case is far advanced.

It is to be regretted that no uniform account can be given of the progress of these cases from the first: the following extracts and notes may however be worth re-stating and recording.

Dr. Eyre (*loc. cit.* p. 514) says "that one or more hard lumps appeared on the foot, in various parts, began to enlarge" and continued to do so. "At last the tubercles began to ulcerate and pain be felt"—all this time the general health is little, if at all, affected.

In Kutch, Mr. Bazunjee Rustomjee found, in the early stage, little or no swelling of the foot: "the integuments are natural in colour or slightly congested and hot, having in the surface elevations which, when burst or opened, allow a thin yellowish puriform discharge to exude containing granules like poppy seeds." "The skin on the plantar surface is irregularly thickened and converted into knots at intervals, and gives, on handling, the feeling of lumps." As the disease advances, the swelling of the foot increases, and numerous sinuses form. From the same locality, Mr. Sudasew Hemraj writes that the disease commences by a small irregular and somewhat painful swelling on some part of the foot. It slowly increases, suppurates, bursts,

and discharges a thin purulent matter. The pain subsides, and the opening remains fistulous: this process is repeated, and so the disease spreads.

The following cases may be added:—

In July 1854.—A man æt. 28 was admitted into the Jamsetjee Jejeebhoy Hospital with an affection of the foot which, to all appearance, presented an early stage of the fungus disease. There was a swelling at the outer ankle, the size of a mango, having numerous suppurating pustules in its surface, which made their appearance some months after the tumour itself: the whole duration of the disease was about a year. The so-called "Tumour" was spreading over the foot when he was discharged. Though a resident for some time of Bombay, this man was a native of Rajcote, where the fungus disease is not uncommon.

In another *case* it commenced with bullæ on the great toe, and after several months when the foot had become much swollen, other tubercles appeared. (*J. J. H. Dec.* 1855.) *Dracunculus*, I may remark, first appears by vesicles, or bullæ.

It is not unlikely that the disease in question may commence in all the ways now mentioned: there is a general accordance in these statements which will give a fair idea, sufficient to materially assist our *diagnosis* in doubtful cases.

Shortly before sending this article to press a most favorable opportunity of examining the parts at an early stage presented itself: the interest of the subject will excuse my dwelling on it.

Under date 10th September 1860, Dr. R. Wilson forwarded to me, from Madura, the following note, with preparation:—

The accompanying "specimen is just removed from the plantar surface of a boy's foot: the disease was of 13 months' standing: no cause can be assigned for its appearance. One or two people in his village had suffered from "tuberculated foot" some years since. The disease in this case made its appearance in the dry season, in the form of a single tubercle which ulcerated and discharged a fluid said to be aqueous (unlike pus), and gradually increased in size till this time: this discharge ceased a month or two since. Another small tubercle also formed on the upper and outer edge of the foot a few months ago, this I also removed and send you. Should this be the genuine disease, it is the first time I have seen it at so early a stage."

Description of this example of incipient fungus-disease.—The larger piece has the appearance of an elongated flattened tumour, the rounded surface of which is marked with white patches, and presents seven circular depressed spots of $\frac{1}{3}$ to $\frac{1}{2}$ inch, or more in diameter. The superficial dark layer of cuticle is cast off, leaving a very regular circular white surface, the centre of which presents a depression, closed at the bottom by a brownish layer very

thin in the middle, as is seen on section. It is also then found that a small cavity exists beneath this depressed spot; or a tubular prolongation may be detected running down through the remaining thickened cuticle and cutis into the subcutaneous cellular tissue, where it is not difficult to find the fungus particles, pink or yellowish coloured, or they may be found in the cavity above-named, in the superficial part of the cutis, or even on the surface of the latter,—the cuticle being raised.

The smaller specimen tells the same tale; most clearly showing the development of these fungi at the very spot where, in all probability, their germs were introduced. In other parts of these very interesting preparations there is a prolongation of the growth into the subjacent tissues, and there pink-coloured particles are to be seen. The local nature of the whole affection, its very beginning, are here unmistakably displayed. I must say the superficial appearance of the skin gives the impression that a vesicle or blister once existed there, and it is not at all unlike that left after a *guinea-worm* has begun to discharge; as is well known the end of the worm makes its appearance in the centre of such a circular spot.

A further examination of these particles, shows their perfect resemblance to those of older specimens, and bodies not unlike spores were occasionally seen.

It is also now in my power to indicate the manner in which the *black* variety of fungus disease makes its appearance. The Hydrabad specimen (see p. 114) reveals the following:—

After the removal of the cuticle from the sole of the foot, numerous pinkish spots were seen, and on cutting through the cutis over them, I found beneath it, a deposit of pink, red, or orange-brown colour, in the form of streaks longitudinal or radiated, and imbedded in the subcorial tissue. The deposit is composed of minute bright globules measuring $\frac{1}{4000}$–$\frac{1}{6000}$ in diameter, others being larger and of a darker colour. Sometimes it is apparently in tubes, which branch or stretch out, such as one would suppose to occur if the *sweat-ducts* were filled with spores: often, however, the accumulation appears outside the glandular tubes, and occasionally spherical groups of spores were seen.

Over these pink spots, no aperture in the cuticle was seen, so that if the globular bodies are spores, they must have entered through the orifice of a sweat-duct, and from their size, this is perfectly possible; indeed one is compelled to adopt such a conclusion.

It may be considered as almost demonstrated that the spores of this fungus are introduced from without. I have seen, but not yet minutely examined, similar appearances to the above in other specimens in the possession of the College.

A practical Remark

It may be convenient to introduce in this place.

In the case just mentioned, I believe the whole of the disease to be eradicated; but partial operations on the foot at a later stage, are not so sure. A woman, æt. 22, was admitted into the Jamsetjee Jejeebhoy Hospital, August 2nd, 1854, whose left foot had been affected for 7 years, general health good. Syme's operation was performed; but a few months afterwards, small abscesses had made their appearance in the neighbourhood of the stump: further treatment was declined by the patient.*

Assuming the correctness of the view now enunciated of this affection, it will be clearly necessary that *the whole of the affected part be removed,* in any operation proposed. And it should be borne in mind, that the *bones of the leg* are sometimes affected near the ankle-joint; and what is equally important to be aware of is this, that the fungus-growth extends some distance in the *soft parts.* I have a specimen in which the deposit extends upwards of 4 inches above the ankle-joint on the back of the leg, so near indeed to the place of operation that the stump may possibly have contained a small part; this entails a risk which might be readily avoided.

No operation can prevent the disease arising *de novo* if the patient be still exposed to the exciting cause.

Description of the Fungus.

I have deferred this until now, that a common description might be given of several specimens, and so repetition avoided.

As before said, four examples of the *first variety* have already reached Bombay.

This species appears in the form of globular masses, the size of which may be compared to a pin's head up to a bullet: their consistence is firm and friable, and their external surface of a deep black colour, and studded with minute tubercles which give the masses a mulberry appearance, on being magnified.

A sectional surface presents a radiated appearance, and is of a rich deep brown colour. Some of the masses readily break up along the course of these radii and have then rather a softer consistence, like that of decayed wood: in other cases this disposition is not so apparent.

* See also a similar case referred to in Appendix A.

The general form is not in all cases perfectly spherical, sometimes one or more masses seem to have blended, or the growth has been irregular. The minute structure is as follows:—The larger masses are composed of fasciculi, which radiate towards the surface in a very regular manner: they frequently branch and blend with neighbouring fasciculi; they appear somewhat knotted, and are cylindrical in form. Their peripheal extremities, and in some cases, the lateral branches, bear one or more dark-coloured terminal, globular, and very firm expansions, the varying size and projection of which give the tuberculated appearance of the exterior before alluded to. Their diameter was found in one specimen to range from $\frac{1}{150}$ in. to $\frac{1}{400}$ in., the globular dilatations are frequently $\frac{1}{120}$ in. or larger, in diameter.

The branching fasciculi appear to be chiefly fibrous in structure, being made up of very minute fibres which branch and inosculate, and are apparently homogenous throughout: numerous granules are intermixed, and frequently a large cellular beaded fibre may be seen among these smaller ones. Such cellular beaded fibres form the great mass of the globular dilatations; they are seen of all sizes, branching and giving off inflated cells laterally, or ending in such: most are clear, some granular and nucleated. Irregularly interposed may be seen the spores. Diameter of fibres $\frac{1}{6000}$ to $\frac{1}{3000}$ in.

Such is the structure of those masses which are softer in consistence, and readily break up in the radiated manner described.

In other cases, the whole mass throughout is more friable, and appears to be made up of the beaded fibres so aggregated as to give the impression that the entire mass is built up of elongated cells regularly apposed. These are of equal consistency throughout.

It would seem that the *smaller masses* are nothing more than the clustered and dilated extremities of the fasciculi composing the larger masses, having become probably detached, or cast off from their external surface: in the very small granules (less than a pin's head in size) the place of detachment may be seen.

The general shape is highly lobulated, and flattened. Their structure is similar to that of the parts before described,—close-set, elongated, and branching cells forming fibres, radiating towards the surface and having interspersed amongst them, it would seem in greater abundance than before the detachment of the cluster, the cells which form the *spores*. These are oval, clear, or granular, with a spurious (?) nucleus, $\frac{1}{800}$ to $\frac{1}{2000}$ in. long diameter, thick walled, and frequently seen to be giving off prolongations which become beaded fibres: sometimes they appear to have been ruptured. See plate 1 for full illustrations.*

* In making the earlier examinations of this striking growth, I have to acknowledge the valuable assistance kindly afforded by my Colleague Mr. H. J. Carter, F.R.S., whose microscopic investigations of the lower forms of living bodies are well known.

These black granules are found along with the larger masses, or by themselves, in some of the deep-seated sinuses; they form a characteristic element of the discharge from the sinuses, being thus conveyed towards the exterior. They are imbeded in a fleshy mass, presenting:—1. Myriads of small cells, some clear, compound, oval, dividing. 2. Numerous large granule cells (black), others light, round, or irregular. 3. A frame-work formed of what appears to be a close network of tubes, crammed in some places with large clear vesicles, or like blood-vessels. Fat globules and crystals abound.

Investing these curious and striking black masses, and lining the cavities in which they are lodged, is a rather tough fibrous membrane, somewhat adherent, particularly to the smaller particles. It contains numerous oil globules, is very soft and fleshy on its inner surface, and is prolonged towards the skin by funnel-shaped processes which terminate at one or other of the apertures seen on the external surface: structure obscurely fibrous with nuclei. The *mycelium* of this species is unknown, unless it be represented by the soft tissue in which the smaller particles are imbedded, which I am not prepared to deny, until a thorough examination of a perfectly fresh specimen shall furnish correct data for an opinion. (See note at the end.)

What has been previously termed by me the *second variety* of this disease includes probably several forms which may eventually have to be distinguished.

My observations are founded on the examination of 8 or 10 examples now in the possession of the College.

The fungi are in all cases in the form of small, or even minute particles of a whitish-brown or pink colour. We may distinguish the following:—

1. Separate, light-coloured, particles, so minute, that they are only just visible to the unaided eye: very numerous, and plentifully discharged from the sinuses.

When magnified, found to have a tuberculated exterior, and to be composed (apparently throughout) of very distinct and unmistakable beaded cellular filaments, similar in appearance, but smaller, to those found in the first variety. Imbedded in a greenish slough-like glairy substance, which, on exposure to air and the action of spirit, shrinks into mere shreds. It is stated in my rough notes to be composed "of numerous filaments, forming a kind of network, with much granular matter, oil globules, and granular cells. The filaments appear, in many cases at least, to be hollow, &c." I regret that this description is so incomplete, as my present conviction is, that the substance referred to may represent the *mycelium*, and the fungi, *spores* spontaneously generated in it. No other similar case has yet come into my possession, and this one gave a clue to all the rest. (*See* Plate 2; the recorded case (p. 115); and the note at the end.)

2. Single, or compound particles, brown or bright pink coloured, visible as reddish grains to the unaided eye; very numerous.

Form oval and regular, when single: frequently double or quadruple, triple, or dividing into six or eight, then each particle is angular in form; often cuboid.

Ultimate structure obscure: no cell-wall or nucleus; uniform throughout, and either of minute beaded fibres, or more likely made up of *very* minute rounded nuclei, which escape on bursting. Intermixed are spheroidal masses of fat crystals, many fat globules, which, like the *fungi*, are tinged pink, so that the uniform reddish colour of the fleshy substance in which they are found is owing to both structures. This matrix (*mycelium?*) was probably similar to that described in the last case. (*See* Plate 2; the account of the *Madura* specimen (p. 116); and the note at the end.)

3. Light coloured or brownish granules, compared to poppy-seeds, or mustard seed, &c.; very distinct to the eye, and often aggregated into mulberry-like masses of varying sizes: very numerous; consistence compared to that of cheese.

Structure, in all cases composite; each granule being formed by the aggregation of minute bodies, which resemble more or less the separate particles above described, dozens of which must go to form a single granule. Every minute particle is surrounded by an investment of crystals, giving the appearance of a wreath or fringe to each: they are structureless, and of a fatty nature, and may equal in length the radius of the fungus particle. The mulberry-like masses are but aggregations of these granules. Spherical clusters of granules may be seen $\frac{1}{400}$ – $\frac{1}{500}$ in. in diameter.

Fatty crystals and oil globules are abundant. The fleshy matrix above noticed probably exists in a modified form, but as no *fresh* specimen has reached me, no conclusion can yet be made. (*See* Plate 2; the case from *Bellary* (p. 119); the College specimens.)

4. Of this variety, I speak with some hesitation: but it may turn out to be a transition state from the *black* to these *light-coloured* species: the colour is that of mahogany. Its peculiarity is as follows; with many of the appearances of the last described, as regard colour, form in mulberry-like masses, &c., it has the structure of the *black* variety: only the beaded fibres are not distinct. The smaller granules very much resemble in form and size those of that variety. Spheroidal masses of acicular crystals, perfectly white in colour, are abundant: they are probably fatty in nature. (From Bellary.)

Such are the results of many careful examinations of these specimens; and it will be evident that the subject, being new, is as yet but very imperfectly investigated.

As to the *relation of the two varieties*, I do not venture to offer a decided opinion; but will leave those interested to make their own deduction from the following statements:—1. That the external appearances in both cases are similar. 2. The structural changes also seem so. 3. The clinical history is also the same.

With regard to the fungi I observe that, although they differ materially, yet there are indications of transitional forms.

The conclusion that the two varieties are closely related, will not appear to many to be far-fetched.

That the *individuals included in my second variety* are possibly *identical*, may be surmised from the following circumstances :—

1. There is general similarity of size, thus the fungi measure in diameter.

$\frac{1}{43} - \frac{1}{100}$ in.	$\frac{1}{50} - \frac{1}{130}$ in.	$\frac{1}{43} - \frac{1}{87}$ in.	$\frac{1}{43} - \frac{1}{80}$ in.
Case of the woman (p. 115.)	Madura specimen.	Bellary specimen.	College specimen.

judging from a few average measurements.

2. Their *form* presents all intermediate gradations from the case of the woman to that of the College specimen, which the Bellary one resembles, as well as, lastly, the Madura foot.
3. The *colour* too has its gradations amongst them.
4. Their *number* and *general disposition* is the same.
5. The foot is very *similar in appearance* in all cases.

Their minute structure is, however, not the same: in only one case is the *fungus* absolutely determined to be such, but in every other instance, the appearances are only negative, and, I may add, unlike any other body I am aware of, animal, vegetable, or mineral. That in these cases the fungus has undergone some change, *e.g.* died, and degenerated, is not unlikely; for, as before said, there are indications of the original structure when carefully looked for. I feel confident that something of the kind will turn out to be correct.

The crystalline coat, or fringes, which form such a striking feature in the more frequent varieties of the disease, are doubtless of a *fatty* nature: the general appearance, want of structure, and action of re-agents as æther, soda, potassa, acetic acid, have satisfied me on this point. The co-existence of numerous oil globules, and undoubted fat crystals in all cases, is confirmatory. They are not *essential* parts, as their absence in the Madura specimen, and the case of the woman, sufficiently shows. In the latter, I found some commencing to be formed around the fungus nucleus.

Their appearance possibly indicates the death of the fungus, but they were found in the specimen of incipient disease before described (p. 132.)

Natural History of the Disease, and Conclusion.

The natural course of the fungus disease is as yet matter of speculation, but this is nothing peculiar. The first origin and implantation of similar growths on rye, barley, oats, and many grasses, are as yet unknown : and the natural history of the guinea-worm is only now beginning to be understood.

It must be admitted that, in this affection, *spores* are someway introduced beneath the skin : whether through a natural aperture, or abraded surface, is uncertain. They develop themselves in the tissues, and spread to the deeper seated parts, not sparing any. Irritation near the surface of the skin, towards which the growth seems to extend, after a certain interval, produces the vesicles before noticed, or the soft tubercles, or so-called abscesses, which on being opened are found to contain numerous plants. Accompanying irritation no doubt produces the fibrous thickening of the parts around, which sometimes resembles elephantiasis. This branching of the internal growth towards the surface eventually produces the numerous sinuses so characteristic of the disease,—it will be remembered they are all lined by a membrane which encloses the fungi (and spores), which are on their way to be expelled; just as is the case with all fungus growth : the spores are always set free *in air*. So, too, are the young of the Guinea-worm.

Judging from the history of the cases, we must allow that inoculation of the foot takes place at one or more spots ; and that, from the spores there introduced, the whole foot may become affected. The diagram in plate 2, strictly copied from nature, will aid in conceiving how this growth takes place.

It is also certain that a period of incubation must occur between the inoculation of the spores, and the formation of tubercles or abscesses : we are in perfect ignorance as to the length of this period, but are better acquainted with the time required for the guinea-worm to develop itself.

The comparison of this affection with guinea-worm has often been made in this paper; indeed, their mysteries are common,

as to mode of introduction, stage of relative development, the commoner cases of both represent their origin, and the destination of their products.

The vegetable parasite appears to require longer time to develope; it attacks deeper parts, as the bones, and hence produces a more serious disease than the animal parasite does. In either case the constitution is unaffected, and a cure obtained only by removal of the foreign body: but whether this is ever spontaneous in the present disease, is not I think probable: it generally is in guinea-worm.

India, then, offers examples of the two most important parasitic affections known (as common diseases): a new disease being now added to the list, at the expense of getting rid of an obscure though important affection of the foot: the practical advantages of the transfer may afterwards became apparent: at present pathology is satisfied.

Note.—With reference to the place of classification of the fungi now described, it may be observed that, unless the whole history of the species be known, its determination is difficult, if not impossible. As regards the second and more common variety of this affection, it is my impression that it will eventually be found to belong to that order of fungi (called by Payer *myxosporæ*) in which the spores arise in the midst of a mucilaginous substance representing the *mycelium*, and having no very distinct organization. The fleshy, glairy, slough-like tissue, found in the case of the woman, and in the Madura specimen (and probably in all others of the kind, when fresh), may represent this little organized mycelium. The spores are said by Tulasne to arise by nuclei in this mass (au sein duquel nagent librement les spores.—*Payer*): they are often brown or black, and in some species are grouped in six or eight, so as to resemble compound spores. My readers may themselves judge if this description will apply to the cases mentioned above, particularly the Madura specimen (See plate 2), in which the fungi (spores ?) are dividing into 2, 3, 4, 6 or more, as I have subsequently made out, as well as in the Bellary specimen.

One of Payer's figures (*Thecaphora deformans*) might represent the chief characters of these spores. This order of fungi,

according to him, includes most of the ento-phytal (*Ento-zoic*) fungi, and is represented by the bunt, or smut, of our cereals, or ergot, in Europe.

I am not at all certain that the mode of development and growth is not similar in the case of the black variety of fungus disease; the most recent examinations make this very probable. As before said, spores have been found immediately beneath the cuticle, and very likely were contained in the gland ducts of the skin, having been introduced through some natural aperture.

Appendix A.

Very satisfactory and conclusive evidence that this disease prevails in the Bengal Presidency, is contained in the Indian Annals, No. XIII., p. 316. It is in the form of a short article by Mr. Peter A. Minas, G. M. C., Bengal, Sub-Assistant Surgeon at Sirsa, entitled "Observations on Keereenagrah (tuberculous disease) of the Foot;"—and the following is a brief summary.

The meaning of the native name is explained: the characteristic symptom of the disease is stated to be the presence and constant discharge of particles soft, or black and hard: there are numerous fistulous openings in the part affected. The disease commences by a hard and tender swelling, which gradually enlarges: usually first seen in the sole of the foot. It has been seen in the hand. Cause unknown, but attributed to an injury in most cases. Locality—prevails to a limited extent in the district around Sirsa, but patients come from Bicaneer, Bhawalpore, and Hissar.

Eleven cases have occurred to him, including one female: seven cases also, one a female, had occurred to his predecessor. Of the eleven cases, ten were treated by amputation, and all were cured. In 3 cases the left foot was affected; in the others the right. The average age of the patients was 33, and the duration of the disease 7 years.

Confirmatory of my previous remarks on amputation in these cases, Mr. Minas records a case of partial amputation, one toe being removed; but amputation of the leg was afterwards required.

Appendix B.

Note from Dr. Asher, referring to his case recorded in the text, *p.* 114*: dated Hydrabad, Sind, 7th February* 1861.

"Name of patient—Belan Mungwana; a prisoner in Hydrabad Jail. Right foot amputated for fungus disease. Born and resident all his life in the neighbourhood of Kotree: been occasionally employed in agriculture, but for the most part made his livelihood by beating the tom-tom on festival occasions. The produce of his native district consists of grain and cotton, but in the culture of the former alone has he been engaged. The small tract of country to which his residence has been confined, lies along the right bank of the Indus, and the soil is light clay. Has never known any other person suffer from the disease under which he labours, but has heard of it from others, and believes it is called in the vernacular "Nagro;" a term, however, which seems not familiar to many, and apparently not confined to this particular disease. The natives have no superstitious views as to its cause, nature, or cure: they consider it as incurable, and attribute it to "naseeb." Said never to be known in any other part except the foot, and in the subjects of it, no hereditary tendency, nor particular diathesis can be traced.

Within the last few days, since writing the above, another instance of this disease has occurred in my practice. The history of the case, and appearance of the foot, were identical with the former one, of which the foot was forwarded to Bombay as a specimen in November."

NOTES ON THE PHYSIOLOGY AND DISEASES OF THE PANCREAS.

BY ASSISTANT SURGEON W. J. MOORE, M.D., L.R.C.P. EDIN., &c.

Presented September and October 1860.

Part 1.—Physiology of the Pancreas.

THE Pancreas or Pancrene, derived from the two Greek words, πᾶν *all* and κρέας *flesh*, has, at different periods, been the subject of continued investigation and research. From the writings bequeathed to us by the older authors, it is sufficiently manifest that the organ was formerly supposed to be the seat of divers multifarious and dreadful disorders; a reputation, however, which it only shared with the liver, thymus gland, and appendix of the cæcum coli.[1] Thus Schenkius[2] stated:—"The pancreas and intestines are the seat of numerous and wonderful diseases." Fernelius[3] considered it the seat of diarrhœa, dysentery, cachexia, atrophy, languor, and slow fever; and Riolanus supposed hypochondriasis, and other chronic diseases, were excited by its obscure maladies.[4] At a somewhat later date, Dr. Baillie[5] remarked, that, upon the whole, it was less liable to disease than any other important organ of the body; and with greater probability referred the affection called pyrosis, as a symptom of its disordered state; which opinion was also espoused by M. Mondière, M. Guersert, and our countryman Dr. Copland.[6] Dupuytren again, with less reason, considered its

[1] Copland's Med. Dict., Art. "Pancreas."
[2] Exercit. Anatom., lib. i, sect. 2, cap. xxii.
[3] Fernelius, liber vi., cap. 7.
[4] Copland's Med. Dict., Art. "Pancreas."
[5] Baillie's Works, p. 207.
[6] Copland's Med. Dict.

functional or organic disease, might be the cause of cholera;[1] Wedeking and Portal[2] of chronic diarrhœa and cholera; while the lamented Bright[3] connected its maladies with a peculiar condition of the alvine evacuations; the discharges being fatty, and the disease eventually terminating in jaundice. This latter opinion has also been more or less espoused by Schiff,[4] by Bernard,[5] by Herbert,[6] by Colin,[7] by Leared,[8] and others. The French physician Corvisart,[9] has supposed the assimilation of azotized matter to be one of its chief uses; and hence connects its diseases with dyspepsia. It has also been thought to assist in the formation of hæmatosine by Tiedemann and Gmelin; as great emaciation and anæmia, have been usually present in cases where chronic disease and obstructions have been found after death.[10]

That it is an organ of great utility is sufficiently evident, from the fact of its being found in all animals, birds, reptiles, and in many fishes, mollusca, and insects:[11] and moreover, its intimate connection with that important part of the intestinal tube, the duodenum,—from which it can scarcely be separated,—together with its early development, as Baer[12] demonstrated, coeval with the salivary glands, and formed, like them, from a kind of vegetation process, of what appears the rudiments of the intestinal canal,—would also induce the belief that the organ was destined to play an important part in the future internal economy.

Although the importance of this gland must therefore be admitted, it is I believe a fact, that no complete monograph or

1 Dupuytren, in Biblioth. Méd., tome xii., p. 20.
2 Portal, Cours d'Anat. Médicale, tome v, p. 355.
3 Med. Chirurg. Trans., vol. xii.
4 Schiff, on the Action of the Pancreatic Juice and Bile in the Absorption of Fat. Moleschott's Untersuchungen zu Naturlehre, band ii, s. 345. 1857.
5 Bernard, Archiv. Gén. de Méd., No. xix.
6 The Ligature of the Pancreatic Duct, by Herbert. Zeitschrift für rat. Med., vol. iii.
7 Colin, on Digestion of Fat. L'Union Médicale, tome xi. No. 50.
8 Medical Times and Gazette, June 1854.
9 L'Union Médicale, No. 50.
10 *Op. cit.*
11 Paine's Institutes of Medicine, p. 142.
12 Müller's Physiology, Art. "Pancreas."

memoir, embracing its physiology, pathology, and diseases has yet appeared in the English language, excepting as a translation; certainly, numerous papers on the subject are extant, published in one or other of the Encyclopædias and Medical Journals, among the former of which perhaps Dr. H. W. Carter's production may be considered as one of the best. [1] The latter, whether of recent date or otherwise, have been for the most part composed by the authors, either in support of some preconceived opinion, or to elucidate some diseased action which has fallen under the cognizance of the writer. Our continental neighbours, however, have not been so neglectful of this gland and its maladies and physiology; for, in addition to the authors already quoted, there are the old works of Hoffmann, [2] Brunner, [3] and Rahn, [4] published respectively in 1709, 1713, and 1796, and the more recent volumes of Sœmmering, [5] Mondière, [6] Bécourt, [7] and last, though not least, of Professor Claessen. [8]

Notwithstanding what has been asserted regarding the importance of the pancreas, it cannot be regarded as a vital organ, momentarily necessary to existence. Brunner [9] long since related that the pancreatic ducts of several dogs having been tied, "they still continued to eat and drink, and perform the other functions of life as usual, one of them seeming only to have the better stomach for it." Bernard [10] again informs us that the dogs he experimented upon remained alive with voracious appetites, after having had their pancreatic ducts filled with oil and ligatured. The rabbits experimented on by Bidder and Schmidt [11] remained alive for a time, but afterwards sickened and died; and this indeed I have found invariably takes place,

1 Carter, Cyclop. of practical Medicine, vol. iii.
2 Hoffmann, Dissert. de Pancreatis Morbis, 1713.
3 Brunner, Experimenta nova circa Pancreas, 1709.
4 Rahn, Pancreatis Observationes, 1796.
5 Sœmmering, Obser. de quibusdam Pancreatis Morbis.
6 Mondière, Recher. Hist. Pathol. du Pancreas.
7 Bécourt, Recher. sur le Pan., ses funct., et ses altérations organ. 1830.
8 Claessen, Die Krankheiten der Bauchspeicheldruse, etc. 1842.
9 Brunner, Experimenta nova circa Pancreas.
10 Bernard, Archiv. Gén. de Méd., No. xix.
11 British and For. Med. Chirurg. Review, vol. xii.

when the animal is allowed to live, or does not sink from the primary effects of the operation. Carter[1] states that many animals thus experimented on die exhausted by incessant and continued vomiting; and I am enabled to affirm the truth of this assertion; but have not observed that increased appetite and voracious desire for food, noted by the authors quoted above. On the contrary, the ligature of the pancreatic duct has been followed by general wasting, by loss of appetite, by enlargement of the liver, spleen, and lymphatic gland, and by the establishment of a thoroughly cachectic state, a condition apparently simulating that diathesis to which the term "splenic Leucocythæmia" has latterly been applied.[2]

I shall, in this paper, pass over the general anatomy of the pancreas as being at the present day well understood by every advanced anatomical student, and merely notice, *en passant*, a few of the varieties which have been noticed, from time to time, existing in its various parts. Thus the gland has sometimes been found double; sometimes rounded instead of bifurcated at its left extremity; and occasionally, the organ has been so small as to lead to the idea that it was absent altogether.[3] The duct too, which was first discovered by Wirsung in 1642, is subject to many variations. It is sometimes found double; it frequently takes a tortuous and winding course; sometimes it opens directly into the duodenum, at others joins the *ductus communis choledochus;* occasionally, there are several ducts proceeding from different portions of the pancreas, and either opening separately or jointly into the duodenum, or common bile duct.

The minute anatomy or intimate structure of the gland cannot, however, be passed over so easily, although indeed its full description need not occupy any very considerable space. The perfection to which lenses have latterly been brought, certainly presents us with greater advantages than were enjoyed by our predecessors, and microscopical anatomy and pathology are now recognized departments of our science. As regards the pancreas, however, these additions have not added much to our practical

[1] Carter, Cyclop. of Pract. Medicine.
[2] Lancet, Mirror, January 1860.
[3] Claessen, Die Krankheiten der Bauchspeicheldruse, etc. 1842.

information, whether of disease or physiology; although indeed they have assured us of the intimate similarity existing between the pancreas and other secreting organs, and so reduced our analogous reasoning to a certainty, and confirmed the belief that this gland is not merely placed in its peculiar position to serve as a cushion for the too distended stomach, as was the opinion of the celebrated anatomist Vesalius and other older writers. [1]

The pancreas may therefore be described as a racemose cluster of secreting follicles, which form the termination, or rather arise from the divisions of the secreting duct or ductus Wirsungi. Clusters of these follicular cells, with accompanying nerves, veins, and arteries, are surrounded by areolar tissue, and so formed into lobules; these again being held together by other parenchymatous structure. Although, under the unassisted eye, no appreciable difference is discerned in the appearence of different parts of the organ, yet, with a powerful microscope, the cells forming that portion called by Winslow the pancreas minor, are discovered to be somewhat larger in size than those composing the other and larger portion of the organ.

Now the salivary glands, the parotid, the sublingual, and the submaxillary are also composed of minute follicles, whose diameter is about 1-1000th of an inch, being almost identical in size with the larger ones of the pancreas. They also are connected together by branches of their duct, surrounded by a plexus of minute blood vessels, and bound together by areolar tissue. [2] The ducts also of both the pancreas and these glands are lined with minute ciliary epithelium, and at their opening into the mouth are supplied with a little raised process of mucous membrane answering to the "valvulæ fimbriatæ" of the pancreatic duct, which latter was first pointed out and named by Sœmmering [3] many years back.

Thus the composition of the salivary glands and of the pancreas is very nearly identical, agreeing with each other in the following points:—

1. The general organization including the excretory ducts.

[1] De Graaf, Tractatus Anatomico Medico.
[2] Carpenter's Physiology, p. 271.
[3] Muller's Physiology, Art. "Pancreas," p. 143.

2. Both possessing numerous small blood vessels.

3. Both being placed in positions subject to motion from adjacent parts.

4. The development of both according to Baer [1] taking place at the same period by a kind of budding forth of the rudimentary alimentary canal.

5. Both occurring in all mammalia, birds, reptiles, many fishes, mollusca, and insects. [2]

6. The secretions from both being identical in general aspect, and almost so in chemical composition. [3]

7. The salivary glands never existing in any living being without the supplementary pancreas.

Now the differences which are found are very slight, and indeed are susceptible of various explanations, as will eventually be shown. These variations are as follows:—

1. The pancreatic duct is stated to be found empty after death; the salivary ducts full. [4]

2. The specific gravity of the pancreas,—water being 1,000,—is 2,029. The salivary glands are not so heavy. [5]

The differences between the secretions as stated by Magendie, Gmelin, and Lassaigne [6] are—

1.	Pancreatic	juice	contains	no mucus.	Saliva	does.
2.	,,	,,	,,	a free acid.	,,	none.
3.	,,	,,	,,	no sulphocyanides	,,	does.
4.	,,	,,	,,	S. G. 1,008.	,,	not so heavy.

During the three years I was the Resident Surgeon at the Queen's Hospital in Birmingham, and since that period, I have examined some scores of pancreatic and salivary ducts, and must now record my experience, which is to the effect that both pancreatic and salivary ducts are sometimes found containing liquid, but mostly are quite empty and collapsed. The specific gravity of the pancreas does certainly appear to exceed that of

[1] Müller's Physiology, Art. "Pancreas," p. 143.
[2] Paine's Institutes of Medicine, p. 143.
[3] Lehmann's Physiological Chemistry.
[4] Rees' Encyclopædia, Art. "Pancreas."
[5] Carpenter's Physiology, 5th ed., p. 695.
[6] Magendie's Physiology, Milligan, p. 366.

the salivary gland, but only to a very slight degree ; not more certainly than occurs in the different muscles of various parts of the body, or than may be found in the component parts of the cerebrum, cerebellum, and spinal cord. It must therefore be acknowledged, that, in general characteristics, there is little or no appreciable difference.

The analysis of the pancreatic juice, as given by that able chemist Frerichs, and quoted by Carpenter, is as follows :—

Water	986·40
Solids	13·60
	100·00

Fat	0·26
Alcoholic extracts	0·14
Albuminous extracts	3·09
Alkaline .... { Chlorides ...... Phosphates ...... Sulphates ...... }	8·90
Carbonate and Phosphate of Lime and Magnesia .... }	1·21
	13·60

The composition of the salivary fluid is found to be almost similar, containing moreover a larger per-centage of solid matter, amounting indeed to something more per cent. of the whole. It also contains mucus, but it is probable it derives this addition from the mouth ; it contains also more chlorides and phosphates, together with osmazone and ptyaline, both of which, however, have been stated to be present in the pancreatic fluid. [1] It is very questionable if the latter fluid contains any free acid [2] or sulphocyanides, [3] both of which have been denied to be present by competent authorities, excepting as the products of decomposition, or from the admixture of blood. Thus the differences between the two secretions, as between the glands themselves, appears to be very minute, consisting only in a somewhat greater specific gravity, consequent on a greater abundance of alkaline or albuminous extracts.

[1] Schultz, quoted in Müller's Physiology.

[2] Lehmann's Physiological Chemistry.

[3] Schultz, quoted in Müller's Elements of Physiology.

It has been justly observed by Liebig, that the laws of life cannot be investigated with precision in an organized being, diseased or dying; and hence the product of a diseased or injured organ can only give an approximative result, when submitted to analysis, of its healthy and normal composition. It is not unreasonable to suppose that an injured and excited organ will produce an altered secretion, and in fact this takes place when we endeavour to collect the pancreatic fluid for examination; thus Bernard[1] informs us, the secretion of the pancreas was much increased in quantity when the organ was excited or inflamed from his manipulation; and I have observed the same fact, which indeed is not without signification in the treatment of some diseases; and especially respecting the mercurial action on an inflamed and already too excited liver.

It has already been stated that the duct is very generally found empty after death. Hence we cannot collect fluid for examination after that event; and even were this possible, I should be inclined to place little faith in its integrity; having no doubt that it, in common with all parts of the body, would quickly be deteriorated and altered in its composition.

A description of the pancreatic juice by several authors is now subjoined.

Lehmann[2] states it to be a colourless, clear, very slightly viscid fluid, without smell or taste, s. g. 1008 to 1009. Reaction alkaline, forming, when heated, a slight coagulum, becoming a little turbid on the addition of acid and alcohol; very rapidly decomposed after a few hours exposure, with putrid odour.

Bernard[3] describes it as a colourless, sometimes opalescent fluid, at other times reddish, possessing no vicosity, of saline taste, coagulable neither by heat nor nitric acid. Exposed to a low temperature it may be kept several days; but at 104° it becomes altered. An electric condition of atmosphere quickly decomposes it. Under the microscope, crystals resembling margarine take place.

1 Bernard: Archiv. Gén. de Méd., No. xix.

2 Lehmann's Physiological Chemistry.

3 Bernard: Archiv. Gén. de Méd., No. xix.

Mayer[1] simply described it as a colourless transparent fluid, with acid reaction, and no taste.

Magendie[2] as a yellowish fluid without smell, of saline taste, and coagulable by heat.

Tiedemann and Gmelin[3] state that the fluid they collected was somewhat opaline, ropy, like white of egg in water, slight saline taste. When it first flowed, acid ; and afterwards alkaline.

Leuret and Lassaigne[4] state it to be clear, of saline taste, and alkaline reaction, soluble in alcohol, mixing with water, containing traces of albumen, chlorides, phosphates, and free soda.

Frerichs[5] said the principal constituent of the pancreatic juice, is an albuminous, or casein-like substance, not identical with albuminate of soda, casein, of rptyaline. Imperfectly coagulable by heat, in consequence of being combined with an alkali, precipitated by acetic acid, but slowly dissolved by an excess of the reagent, or by heat.

Herbert[6] describes it as a bluish white fluid, of alkaline reaction, saline taste, and coagulable by heat and acid.

Carpenter[7] observes the pancreatic juice appears to have nearly the same qualities as the saliva.

There are certainly sufficiently great variations in the descriptions of these several observers ; not only is there a difference as to its chemical composition and constituents, but even the colour and coagulability are subjects of diverse statements ; much however of this apparent discrepancy may be explained away; for instance, Bernard,[8] by his own confession, collected his fluid from inflamed glands, because they secreted it fast. Hence probably the reddish colour and crystals this observer noticed ; the latter indeed having been vomited during disease of the

[1] Neckel's Archiv. No. 3., 6170.

[2] Magendie's Physiology, Milligan, 6461.

[3] L'Union Médicale, No. 50.

[4] Müller's Physiology, vol. i.

[5] Wagner: Handwörterbuch der Physiologie.

[6] The Ligature of the Pancreatic Duct, by Prof. Herbert. Zeitschrift für rat. Med., vol. iii.

[7] Carpenter's Physiology, "Man," para. 480.

[8] Bernard: Archiv. Gén. de Méd., No. xix.

organ.[1] Again the fluid was obtained from different animals. Bernard experimented on dogs: Mayer on the cat and ass: Magendie on the dog: Frerichs on the ass: Leuret and Lassaigne on the horse; and others on rabbits, guinea-pigs, sheep, and other animals.

It is not unreasonable to suppose, that the fluid secreted by these various animals, must possess more or less diverse qualities; the omnivorous dog hardly seeming to require the same peculiar digestive solvents, which may be presumed essential to the graminivorous ass or horse. And indeed it has been observed, that omnivorous or carnivorous animals secrete a pancreatic fluid having a less specific gravity, and containing less solid matter than that which proceeds from the same organ of other classes. Thus Frerichs found the greatest amount of solid matter in the pancreatic fluid of an ass: Schultz more in that of the sheep, than in that of the dog; and Wagner still less in that of the cat than the former animal.

The ash also left after calcination of the dried evaporated secretion of the dog, amounted to considerably more than that yielded by the sheep.[2]

The analysis however, of other observers, has given different results, as regards the amount of solid matter in the secretions of the two classes; but the evidence is, on the whole, in favour of what has been stated above; and I believe all experimenters who have calcined the dried secretion, have found the greater ash left from that obtained from the graminivorous animal.

The variations, therefore, between the descriptions of these investigators, as to the acid or alkaline nature of the fluid; as to its coagulability or otherwise; as to its taste, color, &c., are probably due—1*st.* to the manner in which it was collected, which also enhances the state and condition of the animal it was obtained from; and 2*ndly.* to the fluid examined, having been the product of different varieties and classes of animals.

The collection of pancreatic fluid is a proceeding attended with much difficulty,—the deep-seated position of the gland; its close and intimate connection with other important organs; the

[1] Medical Times and Gazette, June 1854.

[2] Müller's Elements of Physiology, vol. 1. p. 526.

shortness of its duct; and the struggles of the animal under operation, all tending to baffle the manipulator, and often-times rendering his endeavours more or less abortive. My attempts at experiment have been confined to dogs, guinea-pigs, and rabbits, and I have found that the gland may be exposed and its duct seized with greater facility in the latter animal than in either of the two former. In one instance, owing to the struggles of the animal, a large artery, and in another the bowels, were wounded by an unlucky touch with the knife, and both these subjects died, apparently from inflammation of the whole abdominal contents, excited by the injury.

The best mode of conducting the operation in these animals is to narcotize them with chloroform, and secure them well in a stout cloth, leaving only the left side exposed. An incision must then be made two or three inches long, at the inferior margin of the last rib. The cavity of the abdomen must be cautiously opened, and the bulging intestines pushed on one side. The margin of the liver will now be reached, which must be raised with its gall bladder, when the pancreas, surrounded by the upper end of the intestinal tube, will be brought into view. If the stomach is full, this organ will also require to be held aside; but if the operation is performed on a fasting subject, and the stomach is collapsed, it will most likely occasion no trouble. The duct of the pancreas must then be sought for, which is best done by tracing it from its entrance into the ductus communis choledochus, or intestine. In the dog it generally joins the former, but in the rabbit it frequently opens into the alimentary canal. Having secured the duct, it may be divided or ligatured as desired. When it is wished to collect the secretion, the most certain method is first to pass a ligature through the duct, divide it below, and then pass the ligature into a flexible tube, drawing the end of the duct after it into the same constituted receiver. This may be passed over the duct as far as it will go, and a small phial attached to the other end. The wound should be then closed with plaster, and the animal placed in a box or basket, and carefully watched, or otherwise, especially if a dog, he may tear the whole apparatus away. An assistant is required to effect these different steps in the operation.

Now the quantity of fluid which was distilled from the pancreas was in my experiments very small; not anything approaching to what has been collected by others. Schuyl[1] states he collected 283 drs. in two hours. De Graaf[2] got half an ounce, and an ounce from two dogs in eight hours. Both Frerichs and Bernard collected it by ounces, and other observers have been equally fortunate; but of what I could truly call pancreatic juice, by which I mean the pure and unmixed secretion, I have never been able to collect more than between two and three drachms. Probably the animals operated on by these authorities were larger than my guinea-pigs and rabbits; and a larger period was also allowed to elapse before removal of the recipient vessel. I considered even two or three hours too long, feeling assured changes would take place in the composition of the secretion even in that short period, and which, of course, the longer interval of eight hours could not fail to increase. One statement, however, of Bernard's I am enabled to endorse, viz. that the fluid is secreted in greater quantity on food being taken, or at the commencement of digestion, although I cannot agree with him as to its acidity when first appearing, and alkalinity afterwards, or as to the reddish color which he describes it to present.

My description of the pancreatic fluid is as follows:—

A light straw-colored fluid, having a very great resemblance to pale, slightly albuminous urine, after the application of heat or nitric acid. If examined by reflected light, its similitude to this albuminous water is still more apparent, as it will be found to contain a slight floating granular material. It is, however, much thicker than urine, being indeed slightly glutinous, and tenaciously clinging to the side of the bottle or test-tube. Its specific gravity is 1010. Heat, nitric acid, acetic acid, and creosote, produce a little addition of haziness. It forms an emulsion with alcohol and æther very readily, and also seemed to mix with plain water, but separated again in about twenty minutes. In some instances there was a slight alkaline reaction, but when the secretion seemed to be collected most pure, it had no visible effect on either litmus or turmeric paper. With olive oil,

[1] Schuyl, De Veteri Medicinâ.

[2] De Graaf, Tractatus de Succi Pancreatici Naturâ et Usu.

mutton fat, lard, and castor oil, it formed an emulsion resembling soap and water and oil, but this, like the mixture with water invariably separated afterwards, leaving a supernatant fluid perhaps a little clearer, and less thick than the untouched secretion. Solution of sulphate of iron blackened it immediately. The *liquor pepticus* of Dr. Nelson mixed with it as water, but afterwards separated. A five or six hours' exposure during the summer months was sufficient to cause putrefaction, when it emitted a slightly pungent, sickly, and disagreeable odour.

Ancient opinions of the use of the Pancreas.—It was stated by Jansson that the existence of the pancreatic fluid was known to Galen and Hippocrates, but this is extremely doubtful, as there is no evidence to show that the duct was even discovered until made known by Wirsung in 1642. Till this period, the notion most generally adopted appears to have been, that the office of the pancreas was to support the vessels; to serve as a cushion for the stomach when in a state of repletion: and to prevent that organ being injured against the vertebræ; to keep the duodenum separate, and thereby distensible, and so afford a free passage to the alimentary material. On the discovery of the duct, however, Sylvius de la Boë promulgated the doctrine, that the pancreatic liquor was acid, and the bile alkaline, and that the mixture occasioned a ferment, coction, or putrefaction in the intestines, by which chylification was effected. These notions were eventually employed as guides in the treatment of disease; the cold stage of intermittent being attributed to the acrimony of the pancreatic juice, and alkaline remedies used to counteract it.

Next we have the theory introduced, that the bile was of so acrid a nature that the pancreatic juice was furnished to temper its bitterness.

Again, it was supposed the pancreatic secretion, by some extraordinary impregnating properties, effected the division of the digested food "into that which is received and that which being fæculent is ejected,"[1] or, "that the food, by the addition of the pancreatic juice, was further subtilized and rendered so

[1] Denham's Physico-Theology, book iv.

fluid and penetrant as to enable it to find its way in at the straitly orifices of the lactiferous veins."[1]

At a later date, the use was stated to be "to mix and incorporate with the chyle, to dilute the thicker parts of the fluid, to render the chyle capable of mixing with the blood, to fit it for its passage through the lacteals, to correct the acrimonious parts of the fluid, to correct viscidity and bitterness, and to change the color of the bile:"[2] also, "to serve as a proper menstruum or vehicle; to change the false qualities of the aliments, so that they assume the same nature, and easily go and return, and consequently perform their proper functions, with the utmost expedition."[3]

Thus, up till a very recent date, there was no definitely assigned action for this pancreatic fluid; and Bernard has the credit of endeavouring to point out the direct action which results from its admixture with the contents of the intestinal tube. This physiologist's experiments were accepted and applauded by the members of the French Academy, by Magendie, Dumas, and Milne Edwards;[4] and they have also been welcomed by the English school; but still are now proved to be more or less fallacious.

Bernard[5] asserted that the essential purpose of the pancreatic fluid, is to promote the absorption of fatty matter, by reducing it to a state of emulsion, capable of finding its way into the lacteals. That the juice possesses this emulsifying power in a peculiar degree, may be considered as fully proved, for on mixing it with oil or butter, or any variety of fatty material, at a temperature sufficiently high to render the latter liquid, and then stirring it for a time, an emulsion is formed, having a slight resemblance to chyle. Bernard moreover states that this fluid does not cease to present its peculiar aspect, although left standing for some time, whereas the bile, saliva, and gastric juice, separate again, after a short period, from the oily substance, as

[1] Ray, on the Creation, Ency. Metropol.
[2] James' Medical Dictionary.
[3] Boerhaave's Institutes.
[4] Comptes Rendus, t. xxvii.
[5] Bernard, Archiv. Gén. de Méd., No. xix.

if they had merely been shaken together. My experience, however, does not lead to this conclusion. As stated in the description of the pancreatic juice, this, when pure, separates from fatty matter, as also do the other secretions mentioned.

It is also stated by Bernard, that in the rabbit, in which animal the pancreatic duct discharges itself some inches lower down in the gut than the bile duct does, when fatty matters have been introduced into the intestinal canal, no considerable change takes place, until such material has passed the orifice of the pancreatic duct, an oily emulsion being then formed for the first time in the gut. So again, Bernard asserts that, by placing a ligature round the pancreatic duct, this emulsion of oily matter is stayed, and the oily material is discharged in the same condition as it entered the intestinal tube; and this position is also strengthened by the clinical observations of the late Dr. Bright.[1]

This able and now mourned physician called attention to a peculiar condition of the alvine evacuations, which contained an oily substance, lying chiefly on the margins and edges of the utensil, having a slightly yellow tinge, and sometimes floating like globules of tallow. The same appearance was also soon noticed by Lord, Elliotson, and Prout,[2] and was thought, especially by Bright, to be consequent on pancreatic disease; the induction being, a want of secretion; a non-assimilation of fat; and hence an evacuation of that material with the stools. Bright, however, observed—1*st.* that partial disease of the pancreas is not necessarily followed by fatty stools; and 2*ndly.* that almost complete destruction of the gland may exist without the phenomena.

M. Moyse,[3] who supported Bright's views, gives the case of a patient, who suffered from pancreatic disease, and who only discharged fatty stools after eating fatty matter; but this patient, as the *post mortem* showed, had diseased bowels and liver in addition to disordered pancreas. Many cases of fatty discharge, occurring in connection with supposed pancreatic

[1] Med. Chirurg. Trans., vol. xviii. Brit. For. Med. Chirurg. Rev., vol. xii.

[2] *Op. cit.*

[3] Moyse, Historique et Critique sur les Fonctions et les Maladies du Pancréas.

disease, have been noticed. Mr. Alfred Clarke[1] records a case of fatty deposit following, as he presumes, atrophy of the pancreas from obstruction of the duct, but it is not stated if liver disease existed. In the museum of St. Bartholomew's[2] Hospital is a preparation of a diseased pancreas, which was co-existent with fatty discharge. A case is also referred to by Kirkes.[3] The Boston Museum[4] contains another preparation, and others might be quoted.[5]

The experiments of Brodie[6] and Magendie[7] also appear to support this theory. The former observed that in cats the chyle was rendered limpid by ligature of the ductus communis choledochus, and hence assumed that the bile was the agent in the assimilation of fatty matter. This, however, was not verified by Magendie, who performed experiments on dogs, and found the same fluid, milk-like and homogeneous. In the cat, however, the pancreatic duct anastamoses with the ductus communis choledochus before opening into the intestines, as a general rule, while in the dog the latter is completely isolated from the former.

It would thus appear that the idea promulgated by Bernard is correct, judging both from experiments, disease, and pathology. There is, however, another view of the question.

It is well known that fatty substances, when given in large quantities, are passed unaltered or imperfectly digested, even in healthy persons;[8] and the evacuations of Bernard's dogs, after being subjected to experiment, may have indicated only an impairment, and not a suppression of the digestion of fat. It has indeed been stated that fatty substance in the evacuations, so far from being rare, is a very common occurrence in certain diseased states of the alimentary canal,[9] and I can safely state

1 Lancet, August 1851.
2 Paget, St. Bartholomew's Hosp. Catalogue, Series xx.
3 Kirkes' Physiology.
4 Descrip. Catalogue of Preparations in Boston Museum.
5 Med. Chirurg. Trans. vol. xviii. Brit. For. Med. Chirurg. Rev. vol. xii.
6 Med. Chirurg. Trans.
7 Bernard, Archiv. Gén. de Méd., t. xix.
8 Schiff, on the Action of the Pancreatic Juice and Bile in the Absorption of Fat. Moleschott's Untersuchungen zu Natulehre, band ii, s. 345.
9 Med. Chirurg. Review, vol. xx.

I have remarked the phenomena in instances where no disease of the pancreas existed, but where the liver was evidently in a morbid condition. That fatty stools are not a certain result of diseased, or even totally destroyed pancreas, is rendered almost certain by the experiments of Brunner,[1] who destroyed the pancreas in dogs, and yet the health remained good, and the functions were regularly performed for a long time afterwards.

Schiff[2] also contests the views of Bernard on physiological grounds, and adduces numerous instances where a considerable amount of fat was discovered in the body of those who had suffered from pancreatic disease, and he also shows that cases are on record in which the evacuation of large quantities of fat-like matter took place with the fæces, without any disease of the pancreas being present.

Donders[3] found fat was absorbed when injected into the intestinal canal. Kolliker[4] ascertained the same thing takes place. Von Wisturghausen[5] found the passage of fat through a thin membrane was facilitated by admixture with bile, but not with pancreatic juice.

Herbert's[6] experiments are very conclusive. This physiologist tied the pancreatic duct of two rabbits, after they had been starved for several days. On the day after the operation they were fed with milk and bread, and a few hours afterwards killed. The intestines were found to contain a quantity of bluish-white fluid, with which the lymph vessels of the mesentery were also filled. *The same result was obtained with roasted bacon, potatoes, and mutton fat.*

Moreover, cases are on record where the pancreas itself was converted into fat. Verger[7] relates a case of this kind, and considers it opposed to Bernard's views. He thinks (and with very great plausibility) that the organ destined to effect the

1 Brunner, Experimenta nova circa Pancreas.

2 Schiff, *op. cit.*

3 Donders, *op. cit.*, band ii, s. 102.

4 Kolliker, Remarks on Absorption of Fat in intestinal canal.

5 Verbrandt der Würzburg Gesellschaft, vol. xii. p. 174.

6 Herbert, the Ligature of the Pancreatic Duct. Zeitschrift für rat. Med. Von Henle und Pfeiffer, vol. iii.

7 Verger, Annali Omedre, vol. cxxxvi, p. 370.

absorption of fat would not itself be fatty. He also suggests that the pancreatic fluid, may only render fatty matter fitted to undergo ulterior transformation: and indeed we find Bernard himself actually inclining to this opinion, when he states that fats are decomposed into fatty acid and glycerine, in which state the bile which does not readily act on *neutral* fat will readily take them up. [1]

The experiments of Bidder and Schmidt [2] clearly prove that the decomposition and saponification of fat is not a necessary part of the digestive process, and moreover the emulsifying of the fats and absorption of milky chyle, is proved not to be absolutely dependent on the development of the pancreatic juice. These experimentalists consider several factors contribute to this result namely, the secretions of the salivary glands, liver, pancreas, and intestines. Frerichs again holds the same opinion, but says "probably the pancreatic juice is the most important and direct" solvent. [3]

The experiments of Bernard may be reduced to three orders: 1st. he tied the pancreatic duct of dogs, and then fed them with fatty matter, and could get no fatty matter or milky chyle in the lacteals, but the unchanged fat was found in the large intestines. 2ndly. he injected fat into the stomach of a rabbit in which animal the pancreatic duct opens separately, and found milky chyle only in the lacteals, below the opening of the duct. 3rdly. he laid open the duct; and, having obtained some of the fluid, found that it formed an emulsion with oily substances.

On the other hand Bidder and Schmidt, having performed the same operation of tying the ducts, *did* find milky fluid in the lacteals, both in the rabbit and guinea-pigs, both above and below the pancreatic orifice, and probably Bernard would have done the same, had he not contrived to kill his dogs from six to eight hours after the fat had been given, when it had had time to descend so low in the intestines, as *to fill those lacteals only below the orifice of the pancreatic duct.* Bidder and Schmidt killed their animals two hours after feeding them. I also have obtained the same result in my experiments.

1 Bernard, L'Institution Méd., May 1848.

2 Bidder and Schmidt, De Adipis concoctione et absorptione, Dis. Maug. 1850.

3 Wagner's Handwörterbuch, page 849, vol. iii.

With regard to the third observation, Frerichs[1] found the saliva and bile formed an equally complete emulsion with fat, and I have already stated that this emulsion is not complete, but separates after a time.

Another experiment of Frerichs seems conclusive against Bernard's views. In young dogs and cats which had fasted a long time, he tied the intestines below the opening of the bile and pancreatic ducts, and injected below the ligature milk and olive oil, and after *two or three hours the lacteals were filled with milky chyle.*

I will now briefly detail my own experiments bearing on this point.

No. 1. The pancreatic duct of a young puppy was tied. He was fed with cooked mutton, containing a moderate proportion of fat, and no change was discernible in the evacuation.

2. The same animal had next day all fat for a meal, which was clearly visible in the evacuations.

3. The puppy was killed two hours after a meal, and the whole lacteal system was found full of milky fluid.

4. The common bile duct and pancreatic duct of a young dog were ligatured, and he was fed with half fat and half lean meat. The evacuations contained undigested fat and fibres of flesh. This animal died from abdominal inflammation.

5. A small quantity of pancreatic fluid obtained from a dog was mixed with mutton fat. It formed an emulsion which separated again after two hours.

6. A small quantity of bile was mixed with fat. This also united apparently, but separated as the former mixture.

7. A mixture of bile and pancreatic fluid was mixed with fat and no separation occurred; the upper stratum being slightly less opaque than the lower for about one-fifth of its depth.

8. A small portion of lean raw meat was placed in pancreatic fluid. It had evidently a greater solvent action on the flesh than plain water.

9. A small portion of lean raw meat was placed in saliva. It seemed to induce the same solvent action as the pancreatic juice.

[1] *op. cit.*

10. A young puppy had a weighed quantity of fat given for a meal the day after ligature of the pancreatic duct. The quantity of fat appearing in the stool was also weighed as nearly as could be, and amounted to 7 drachms. The next day the same amount of fat was given mixed with saliva. Only one drachm could be collected from the fæces.

11. Two rabbits were allowed to live with the pancreatic duct ligatured and divided. Both wasted away and died from a sort of cachexia, with enlarged abdomen.

Now the conclusions which I am disposed to draw from these experiments, and from those of the authors quoted in this paper, are—

1. That the pancreatic fluid differs very slightly if at all from the saliva: that one gland is supplementary or additional to the other: and that it is probably in cases where the pancreatic duct is tied or the gland diseased, that a greater quantity of saliva will be secreted in lieu of the deficient pancreatic juice. Of this compensating action, we do not look in vain for examples among the different organs of the body.

2. That the pancreas, like the salivary glands, is not immediately necessary to life.

3. That it is not proved that the office of the pancreatic secretion is to digest fatty materials, and that the weight of evidence is against this supposition.

4. That it appears equally certain that bile will not do so alone; but that a mixture of bile and saliva, or of bile and pancreatic juice will equally well effect this object.

5. That it is quite impossible to account for this action either mechanically or chemically.

Although I have now, I trust, sufficiently demonstrated that the reception of Bernard's views was premature, and without sufficient enquiry into their truth, there are other expressed opinions regarding the use and functions of the pancreas, which cannot be passed over in a critical memoir.

The division by Drunat,[1] further simplified by Dr. Prout, of the alimentary constituents of food into four groups,—the aqueous, or that capable of absorption; the amylaceous, or that convertible

[1] Trans. Académie des Scien., Feb. 1849.

into saccharine matter; the albuminous; and the oleaginous,—has been again reduced into two great classes, viz. the nitrogenous and non-nitrogenous elements; the first comprising the protein compounds, albumen, fibrine, casein, gelatine, margarine, hæmatosine, &c.; and the latter animal sugars, fats, lactic acid, &c.

Purkinje and Pappenheim asserted the existence in the pancreatic juice of a substance which they called pancreatine, and Corvisart[1] confirms this statement, and moreover promulgates the theory, that the pancreatic juice, by virtue of this said pancreatine, is endowed with the power of digesting azotized constituents of the food, which have escaped the influence of the gastric juice; producing a kind of albumine similar to that resulting from the action of the latter. He also states that the reaction of surrounding fluids, whether acid or alkaline, is of no importance in the performance of this function. Moreover Corvisart observes, that pepsine and pancreatine counteract themselves when mixed; but in the normal condition this is prevented by the gastric digestion itself, through which the pepsine is consumed, or by the admixture of the bile, which destroys the power of the pepsine.

Now this theory does not appear to be strengthened by the noticed results of disease of the organ. If its function is only an adjuvant to the gastric juice, aiding it in the assimilation of nitrogenous material, functional and organic diseases should, by analogous and inductive reasoning, be followed by a non-digestion of these compounds; whereas this is not found to be the case; as patients suffering from pancreatic disease of various kinds are found to digest food containing protein compounds equally well, or in fact better than nutriments of other description. Again, experiments on animals do not show a want of digestion of these aliments, which appear to be equally well disposed of, as the fatty materials have already been proved to be. It also seems unsound physiology to believe, as Corvisart would have us to do, that the pepsine of the gastric juice, and the pancreatine of the pancreatic secretion, are neutralizers of each others powers; and yet that those powers are both exerted in the assimilation of the same constituents of the food.

[1] L'Union Médicale, No. xi. 1857.

The idea of Tiedemann and Gmelin,[1] that the pancreatic juice is the chief agent concerned in the formation of hæmatine, is certainly more plausible than the theory just combated. It has already been stated, that ligature of the duct or destruction of the gland is in most cases followed by the induction of a thoroughly cachectic state, slow wasting, and death; together with, in very many cases, an enlargement of the mesentric glands, similar to what is found after death from marasmus. In the human subject also, this cachectic state is quickly established from disease of the organ; and in addition, there is the peculiar physiognomy, marked by a special pallor and anxious expression; which, although to a casual observer similates that appearance which results from most chronic internal organic disease, yet is not without peculiar characteristics and significance; perhaps impossible to describe on paper, yet immediately recognizable by those who have paid more than ordinary attention to pancreatic disease.

Hence it is not improbable, that a diseased secretion may interfere either directly or indirectly,—most probably the latter,—with the supply of hæmatine to the blood. That this is, however, the true and proper function of the pancreas, I do not believe. The same loss of colouring matter follows all internal chronic disease, and we might with equal propriety, therefore, state the liver, stomach, and intestines, to be the agents in the formation, of this constituent. No chemical experiments have, I believe been instituted with regard to this supposed use of the pancreas and indeed the difficulties with which such attempts would be surrounded, would, I cannot but think, lead to erroneous inferences.

To the conclusion before arrived at, I now venture to subjoin one other, viz:—

6*th*. That it appears certain there is no one discovered object which it is the office of the pancreatic secretion to effect; that the complex process of digestion and assimilation of *any* aliment requires the admixture of *all* the secretions poured into the alimentary tube; and that the part which each fluid performs is now, and will probably for ever remain, a complete mystery.

[1] L'Union Médicale, No. 50.

Part II.—Diseases of the Pancreas.

The physiology of the pancreas having been hitherto comparatively so much neglected, it is a matter of little surprise that the diseases of the organ and their results have not received the attention which has been paid to the affections of other internal, adjacent, and probably more important parts. Every systematic author on 'Practice of Physic,' seems to have considered pancreatic disease as too rare and unfrequent to demand more than passing notice, and accordingly the subject is found but very briefly discussed in any of our standard works. Thus Baillie [1] wrote, "the pancreas, on the whole, is less liable to disease, than any other important organ in the body." Pemberton, [2] writing in 1807, declares the "diseases of the pancreas are rare." Gregory [3] states they are "not characterised by any pathognomic feature hitherto ascertained, that a plausible conjecture can only be formed as to the state of the parts from the symptoms, and that throughout the whole extent of England and Wales, the deaths from pancreatic disease do not average 25 annually." Carter, [4] the author of the best article on the subject which had been published in the English language, notices the paucity of information which then existed, not only in our own country, but also in the writings of foreign authors, and instances the fact that no one but Vogel says one word about the pancreas, and he briefly noticed its diseases, adding the significant words "*notæ deficiunt.*" Guy, [5] in his edition of Hooper, remarks that the symptoms are obscure. Elliotson [6] has expressions to the same effect; and Watson [7] remarks that "the diseases of the pancreas appear to be few, and do not signify their existence by plain and intelligible signs." Among

1 Baillie's Medical Works, p. 207.

2 Pemberton, Pract. Treat. on Dis. of Abdom. Viscera, Art. "Pancreas."

3 Gregory, Practice of Physic, Art. "Pancreas."

4 Carter, Cyclop. of Pract. Medicine, Art. "Pancreas."

5 Hooper's Physicians' Vade Mecum, p. 448.

6 Elliotson, Practice of Physic, Art. "Pancreas."

7 Watson's Lectures on Principles and Practice of Physic, Art. "Pancreas."

our Indian authors, Annesley [1] observes "it is difficult to obtain any knowledge even of the existence of disease of this viscus, during the life of a patient;" while Sir R. Martin and Dr. Morehead do not mention the subject at all. Copland, [2] however, supplies a considerable amount of desultory information; and of late, several interesting communications have appeared from the pens of continental writers, as by Harles [3] in Germany, by Bécourt [4] and Mondière [5] in France; and the still later publication of M. Claessen. [6]

Now I venture to doubt the correctness of the opinion entertained by some of the authorities cited, that diseases of the pancreas are very rare, and although the Registrar General's Returns (as in the time of Gregory), still set down the deaths from affections of this organ at a comparatively low figure, still I believe that very many cases are returned by the certifying practitioners in Great Britain, as fatal from other causes, when a *post-mortem* examination would have disclosed the pancreas to be the organ chiefly diseased.

Without attributing hypochondriasis to disease of the pancreas as Riolanus [7] did; or chronic dysentery and diarrhœa to the same cause as Wedeking and Portal [8] have; or asserting that cholera proceeds from its derangement as Dupuytren [9] thought; there are, as the following list will show, a sufficient number of diseases, proper to the organ itself, which, both as regards their amount or severity, are quite deserving a more searching and specific enquiry than has generally been vouchsafed to them.

I shall enumerate the disease of the pancreas under three heads, viz. functional, structural, and malignant; and inas-

1 Annesley, Diseases of India, p. 316.

2 Copland, Med. Dict., Art. "Pancreas."

3 Harles, Abhandlungen der Phys. Mediz. Soc. zu Erlangen.

4 Bécourt, Recherches sur le Pancreas.

5 Mondière, Recherches Pathol. du Pan. Archives Gén. de Méd., tome xii.

6 Die Krankheiten der Bauchspeicheldruse, &c.

7 Copland, Med. Dict., Art. "Pancreas."

8 Portal, Cours d'Anat. Médicale, tome v.

9 Dupuytren, Biblioth. Méd., tome xii.

much as inflammation, in the great majority of instances, causes alteration of structure, I shall place it under the second head.

FUNCTIONAL.	STRUCTURAL.	MALIGNANT.
Increased secretion of fluid or exalted function.	Acute Inflammation.	Scirrhus.
Diminished secretion of fluid or depressed function.	Chronic Inflammation.	Fungus hæmatoides.
Secretion of depraved fluid.	Hypertrophy.	Cystic Cancer.
Pyrosis, Water-Brash, or Sialorrhœa.	Atrophy.	Colloid Cancer.
	Abscess.	Melanosis.
	Tubercular deposit.	Cancerous Ulceration.
	Calculi.	
	Serous cysts.	
	Hydatids.	
	Fatty deposition.	
	Superficial lymph deposit.	
	Hemorrhage.	
	Induration.	
	Softening.	
	Gangrene.	

Now the gland being subject to this formidable catalogue of diseases, it appears strange that more fatal cases are not recorded, and the fact can only be explained by the supposition that the difficulties of diagnosis are so great, as, in the absence of *post mortem* examination, to mislead many of the practitioners who attend them. The embarrassments which arise during the progress of these cases are certainly immense, and Claessen testifies that he collected 262 reports of instances of pancreatic disease, in only 20 of which, the symptoms were sufficiently clear to establish a positive diagnosis previous to death. I hope, however, to demonstrate that these difficulties vanish upon a careful application of the principles of our science, and that the diseases of this organ are not shrouded in greater mystery than those of very many other important internal parts. From its deep situation, however, and in consequence of the doubt which still exists as to its true and legitimate use, we cannot expect that its semeiotics shall point out its abnormal conditions, in that obvious and unmistakable manner, in which the symptomatology of disease of the lungs (for instance) mani-

fest their deviations from a normal condition. Of pancreatic disease there are scarcely any *signs proper;* and the test tube, the microscope, and the stethoscope, are for the most part unavailable; of symptoms certainly there are a profusion, but inasmuch as most may occur in other diseases, as of the stomach and adjacent organs, a certain amount of inductive reasoning is requisite, before the pancreas can be fixed upon as the viscus primarily in fault.

The symptoms of chronic inflammation, hypertrophy, tubercular deposit, calculi, serous cysts, hydatids, fatty deposition, superficial lymph deposit, together with the group of diseases termed malignant, occurring in this gland, are quite insufficient to declare the existing disease in its earlier stage. Often, however, at a later period, concomitant circumstances enable the physician to arrive at an unerring diagnosis. The co-existence of the scrofulous diathesis, either hereditary or otherwise, with enlargement, which manipulation shows to be of the pancreas, gives rise to a very strong suspicion that such tumour is a tubercular accumulation. The presence of urinary deposits or gravel; and particularly the coincidence of the phosphatic diathesis; would, in like manner, point to the conclusion that an ascertained pancreatic enlargement had its origin in calculous concretion. The occurrence of the 'arcus senilis' is, as Paget[1] observes, "the best indication which has yet been found, of an extensive general fatty degeneration." Hence this condition of cornea, especially if associated with other signs of senile decay, might give cause for supposing that any existing enlargement of the pancreas, would be of a fatty nature. The well known cancerous cachexia, and peculiar appearance of those suffering from malignant disease, would leave little doubt as to the cancerous nature of a tumour; while the absence of any of these conditions of system would probably be a sufficient justification for pronouncing the swelling cystic or hydatic. I find no record that the gland has ever been sufficiently enlarged, from simple hypertrophy alone, to present an appreciable tumour.

[1] Paget's Surgical Pathology, vol. i.

I shall now proceed to consider the functional diseases, and acute inflammation *seriatim;* and shall then notice chronic disease of the pancreas,[1] from whatever cause arising; afterwards glancing at each separate affection; and lastly mention the complications of disease of this organ with adjacent structures.

It would first, however, be desirable to know, who are the class of individuals as regards age, habits, temperament, sex, and occupation, most liable to be afflicted with disease of this viscus; a subject which has hitherto never been investigated. I have, I believe, met with in the course of my professional experience, 34 cases of organically diseased pancreas; I say, I believe of diseased pancreas, because only in 9 cases was the diagnosis verified by *post mortem.* I have also searched the medical periodicals, and find between fifty and sixty more recorded, but out of this number there are only 11 which give all the information required, to arrive at a right conclusion with regard to the above-mentioned enquiry.

From the meagre material at my disposal, I have, however, ventured to form the following opinions,—that the male sex; those following laborious occupation; the intemperate, both as regards food and drink; and individuals of middle age, are most liable to pancreatic disease.

Thus out of my 45 cases, 32 were males; 35 pursued laborious occupations, being chiefly employed in iron works or coal-pits; and 43 were individuals between 40 and 60 years of age.

All ages, however, would appear to be subject to pancreatic disease,—Claessen and Scholler[2] having noticed it in new-born children, and the latter even supposed that it must have existed during fœtal life.

I have already stated, that I conceive the functional diseases to be four in number, and their symptoms are comprised in one or other of the protean varieties of dyspepsia; but a consideration of the anatomy and physiology of the organ, enables us to separate that variety of dyspepsia depending on pancreatic disorder, from other classes having their origin in hepatic,

[1] Claessen, Die Krankheiten der Bauchspeicheldruse.

[2] Scholler, quoted by Claessen, *op. cit.*

duodenic, gastric, or other abdominal derangements. It is true that disease, either functional or organic, existing in any one of the digestive organs, will, in a very limited period, excite a sympathetic or corresponding derangement in other parts, eventually rendering it almost impossible to diagnose the viscus primarily in fault, but in the initiative, a moderate skill rightly exercised, suffices to point out the local *fons et origo* of the evil.

Undue secretion of pancreatic juice, or exaltation of function, may be of long or short duration; may be of very small amount, and induce almost inappreciable results; or being secreted in large quantity, become the cause of very great uneasiness, and ultimately destroy the general health. Experiments on the gland have shown, that great increase of secretion follows irritation and stimulation, and therefore the etiology of this form of disease, must be looked for in something exciting the gland itself. It has been already shown, that there is a very great similarity between the structure and secretions of the pancreas and salivary glands; in fact the former was found by Andral[1] generally and vividly injected in a person who died of parotitis; and from these reasons I have termed one supplementary to the other. Hence, analogous argument leads us to the supposition that the excitant of one must be the cause of undue action in the other, and this, not only by an immediate or specific power of any drug, or ingesta, but also of that mysterious agent we call 'sympathy'; the same well-recognized, but unexplained power of metastasis, which causes the discharge of tears from one lacrymal gland to be accompanied by secretion from the opposite; which causes orchitis to supervene on inflammation of the parotid gland; which excites the female breast to enlarge, during the menstrual molimen; the heart to intermit from disordered stomach; and rectal abscess to form during the progress of pulmonary phthisis.

Whatever excites the salivary glands will, there is every reason to suppose, also stimulate the pancreas. Tweedie,[2]

[1] Andral, Clinique Médicale.

[2] Tweedie, Library of Medicine, Art. "Pancreas."

Hildenbrand, Abercrombie,[1] Copland,[2] Claessen,[3] and all authors on the subject, attribute pancreatic disease to the habitual use of tobacco; but have not shown how the effect was produced. There can be little doubt, however, that it is injurious by exciting the pancreas to great efforts, either by its direct effect when absorbed into the circulation, or by that mysterious sympathy just noticed; and thus another argument against the use of the "fragrant weed" might have been brought forward by King James, or in later days by Mr. Solly,[4] and his supporting writers in the Lancet. In the same manner the habitual use of mercurial pills; the abuse of this mineral and of iodide of potassium; as Claessen[5] thinks, the continued use of cinchona bark; and most assuredly, as Annesley[6] states, the habitual use of heating and irritating articles of diet, and abuse of spirituous liquors, will perform their part in the production of disease, either functional or organic, of the viscus.

The symptoms attending undue action of the pancreas are, in their most marked form,—heartburn; a sensation of fulness in the throat; occasional eructation, not strongly acid, acrid, or bitter; a feeling of deep-seated uneasiness in the stomach; a craving for fluids; and a relief experienced after taking food. The appetite generally remains good, the tongue is but slightly furred, and the patient free from any considerable uneasiness or actual pain. The bowels are generally regular, and the fæces of *natural* appearance.

Now the causes given as inducing this form of dyspepsia are certainly very frequently applied in the East; and I believe this variety of indigestion will be recognized, by most practitioners, as one common in India. In fact it has been noticed by Annesley,[7] who, however, did not trace it to its origin; but it has been ignored, or rather not separated, by Martin,[8] from that

[1] Abercrombie, Pathological and Practical Researches.

[2] Copland, Med. Dict., Art. "Pancreas."

[3] Claessen, Die Krank. der Bauchspeicheldruse, &c.

[4] Solly and others, Lancet 1856.

[5] Claessen, *op. cit.*

[6] Annesley, on the Diseases of India, book iv.

[7] Annesley, on the Diseases of India, book iv.

[8] Martin, on the Influence of Tropical Climates.

class of symptoms arising *a priori* from disease of the liver and stomach; while all dyspepsiæ have been ascribed by Morehead,[1] as due to an asthenic and cachectic condition. It requires, however, a small amount of experience to introduce cases of dyspepsia to notice, where neither liver affections, stomach derangements, or cachexia exist, although the latter will most certainly be induced by the continued presence of the former.

Regarding diminished secretion of pancreatic fluid, or depressed function, I have very little to advance. I believe it is, as a functional disorder, of very rare occurrence, and I also think we cannot judge of its occurrence by any recognizable symptoms. That it does sometimes happen cannot by analagous reasoning be well doubted, seeing that such is a well known condition of the liver and other secreting organs. It appears, however, very probable that any diminution in the secretion of pancreatic juice, would be compensated by an additional supply of saliva from the kindred or supplementary glands, the parotid, the sub-lingual, and the sub-maxillary.

A still greater secretion of fluid, than what I have yet considered, constitutes the nosological disease called pyrosis, or water-brash, or sialorrhœa of the pancreas. I am aware, that authors have differed as to the seat of origin of this secretion, as, for example, Weichmann and Rahn[2] attributed it to the salivary glands, which, however, they supposed to act vicariously for the pancreas, but as it may in nearly all cases be distinctly seen thrown off by the stomach, we must, therefore, chose between that organ and the pancreas; and as the function of the latter organ, is the secretion of a fluid similar to what is discharged in pyrosis; and as the function of the stomach is *not* the secretion of such fluid, the choice does not appear very difficult to make. Harles,[3] Heischman, Guersert,[4] and Schmackpffefer,[5] deny that the stomach ever does secrete such

1 Morehead's Researches, vol. ii.

2 Rahn, Diagnosis Scirrhorum Pancreatis.

3 Harles, Abhandlungen der Phys. Med. Soc. zu Erlangen.

4 Tweedie, Med. Library, Art. "Pancreas."

5 Schmackpffefer, Obser. de quibusdam Pancreatis Morbis.

fluid; and in 30 cases of diseased pancreas noted by Claessen,[1] in 15 there was actual vomiting, and in the remaining half, well-marked symptoms of inverted œsophageal action. I have never seen a case of pyrosis, where vomiting, or at least œsophageal action inverted, was not sufficiently evident; but I find cases of the kind are detailed by Andral,[2] and also that Claessen[3] mentions an instance when fluid was discharged after the destruction of the structure of the pancreas. Andral, however, may have been deceived, and Claessen's pancreas was probably not destroyed; and, as the latter author does not go into details, I think that such supposition may be entertained, particularly as we have the opinions of Copland,[4] Guersert,[5] and Mondière[6] that pyrosis is always due to disease of the pancreas.

The quantity of this fluid which is occasionally evacuated is very extraordinary. Frank[7] saw a case in which six pounds were brought up. Trumpes[8] relates one where two or three pounds were discharged every two hours; and I have seen more than one instance, where as much as a pint has been discharged during the 24 hours; and in several other cases have noticed a *continual* discharge and saturation of linen, which could only have been effected by the evacuation of much more than that amount.

The symptoms of water brash are as follows:—The disease usually comes on in the morning, when the stomach is empty, and is generally accompanied by some amount of gastralgia or cardialgia. The fluid vomited consists of a thin watery material of variable quantity, sometimes slightly acid (probably from admixture with gastric juice), but often quite insipid. The dischage of the fluid gives relief to pain, and the individual feels comparatively well until the next attack, which occurs at very variable intervals.

1 Claessen, Die Krankheiten der Bauchspeicheldruse, &c.
2 Andral, Clinique Médicale.
3 Claessen, *op. cit.*
4 Copland, Med. Dict., Art. "Pancreas."
5 Tweedie, Library of Medicine.
6 Mondière, Archives Gén. de Méd., tome xii.
7-8 Quoted by Claessen, *op. cit.*

But not only is there an increased secretion of fluid, but in many cases there is also alteration in its quality constituting the affection I have entitled "depraved secretion of pancreatic juice." It has been known to be secreted in very large quantities during cases of hysterical retention of urine occurring in young females, and as the fluid in those instances had a strong urinous odour the pancreas has been supposed capable of acting vicariously for the kidneys.[1] I have seen a case of this kind in the Queen's Hospital, the phenomenon occurring in a young woman afflicted with hysterical paralysis of the spine; but such instances can only be regarded as extraordinary contingencies, which hysteria is capable of inciting, as it does mimic inflammation of the peritoneum, palsy, aphonia, laryngitis, dysphagia, hæmatemesis, epilepsy, and retention and suppression of urine. Although I believe the case referred to was really an instance of urinous vomiting, yet such must always be regarded with grave suspicion, as girls have been known to swallow their urine and vomit it up again, when suffering under morbid hysterical impressions.[2]

I believe there are some individuals who cannot suffer from exaltation of function of the pancreas, or from the greater secretion of fluid occurring when pyrosis or sialorrhœa becomes established; and this in consequence of the pancreatic duct opening into the ductus communis choledochus, or even the gall-bladder, and thus allowing its contents to become immediately incorporated with the secretions of the liver. When this anatomical peculiarity is the case, the pancreatic fluid flows into the intestine mixed with bile, and the latter by its well-ascertained irritant powers exciting the peristaltic action of the intestinal tube, the whole is passed off by stool; provided indeed the bile itself is not in excess, or vitiated and depraved; when, probably, what is commonly called a bilious attack would be the consequence. I am aware that diarrhœa and even dysentery have been attributed to increased secretion of pancreatic fluid by Harles,[3] Portal,[4] and

[1] Gendrin, Hist. Anat. des Inflam., tome i.

[2] Watson, Lectures, vol. i.

[3] Harles, Abhandlungen der Phys. Med. Soc. zu Erlangen.

[4] Portal, Cours d'Anat. Médical, tome v.

others, but experiment does not bear out the assertion. I have administered the pancreatic juice on four different occasions to dogs, but found no result from it; whereas the administration of bile caused loose stools, and in one instance diarrhœa, as indeed is the action of the preparation known as Fel Bovinum[1] when given to the human subject. I conceive, therefore, that I am justified in advancing the opinions, that diarrhœa is not a result of undue pancreatic secretion; that when diarrhœa does occur, it is in consequence of the latter fluid being mixed with bile, from the pancrene duct opening into the gall bladder, or ductus communis choledochus; and that those persons in whom the former does so terminate cannot possibly suffer from pyrosis.

I have no means of ascertaining the comparative proportions in which the Pancreatic duct opens into the gut directly or the reverse, but I am disposed to think the former is most frequently the case. Ellis[2] states that it leaves the pancreas and opens *either* conjointly with the common bile-duct or by a separate aperture. Wilson[3] describes it as entering the duodenum by a small dilatation, *common* to it and the ductus communis choledochus, and my reminiscences of the dissecting room and dead-house (comprising considerable practical experience), have impressed upon my memory what I have just previously written.

That the salivary glands are peculiarly sensitive is sufficiently evident from the flow of saliva being much increased by affections of the mind; as for instance thinking of any kind of food which is particularly grateful to the taste. Again, there are individuals so susceptible to the influence of mercury, that the smallest dose of any of its preparations will induce an immediate extra flow of saliva, and in other instances even profuse salivation. It has already been demonstrated that the pancreas is, in every respect, similar to the salivary glands, and excited to action by the same stimulants. It has also been stated, that, in addition to this, there is an evident 'sympathy' existing

[1] I have frequently known inspissated ox gall act as an energetic laxative.

[2] Ellis, Demonstrations of Anatomy.

[3] Wilson's Vade Mecum.

between these secreting glands. Mercury has a direct effect on the salivary glands, and I have found from experiments that it induces a greater flow of pancreatic juice; and hence I venture to submit, that we have an explanation of one 'modus operandi' of mercury, if not totally satisfactory, at least far more rational than the long taught doctrine, that this mineral induces its laxative effects, by "irritating the entrance of the ductus communis choledochus." I believe that in those persons where the pancreatic duct opens into the gall bladder, or ductus communis, the thickened and vitiated bile contained in the former, is diluted and rendered sufficiently thin to flow freely away, and hence probably the benefit of mercurials in that condition described by Annesley[1] as "Congestion of bile in the gall bladder or biliary ducts," and by other authors as deficient or suppressed secretion of bile, or inspissation.

Moreover, it would also appear extremely probable, that the differences found in the action of mercurials when given as laxatives and purgatives to various individuals, is more due to the manner in which the pancreatic ducts open, than to any peculiar idiosyncracy of constitution, as in those instances where the duct opens directly into the duodenum, no dilution of inspissated bile could take place by admixture of pancreatic secretion.

Treatment of functional Disease of the Pancreas.—I shall not dwell long on this subject. I have already indicated the sources of these affections, and their removal will in the great majority of instances cause their effects to cease. Therefore tobacco must be interdicted: the diurnal dose of blue pill forbidden; and the most bland and moderate diet advised, for as Morehead[2] observes in his sketch of dyspepsia, "articles of the materia medica judiciously used may much alleviate discomfort and suffering, but are quite insufficient of themselves to effect recovery."

Where the affection assumes the character of water brash, the tris-nitrate of bismuth is often beneficial, and I have sometimes known the empirical exhibition of astringents as re-

[1] Annesley on the Diseases of India, book iii.

[2] Morehead's Researches, vol. ii.

commended by Watson;[1] the *pulvis kino compositus* of the Pharmacopœia; or a combination of alum with ginger; followed by considerable relief.

Acute inflammation of the Pancreas.—Acute inflammation of the organ is certainly rare, and indeed Andral[2] denied that its existence had ever been proved by necropsy. In this, however, he is decidedly wrong, as cases are to be found in the writings of Tulpius, Bartholinus, Guido Palin, as cited by Abercrombie,[3] in the works of Baillie[4] and Perceval.[5]

Portal[6] and Störck,[7] Harles,[8] Suppin,[9] Casper,[10] Schmackpffefer,[11] and Lawrence.[12]

The latter author, Mr. Lawrence, states, that he attended a lady for acute inflammation of the pancreas, or at least what was supposed to be such, and that the *post mortem* showed the gland injected, and of a dull red colour, and hard to the touch. A similar appearance has been referred to as being found after a death from parotitis.[13]

Casper gives swelling, hardness, adherence to the stomach from exudation of fresh lymph, and redness as the *post mortem* appearances he observed.

Symptoms.—The attack is generally sudden and violent. There is deep seated pain frequently of an agonizing character, about a hands-breadth above the umbilicus. There is urgent vomiting and evacuation of bilious material, great thirst, restlessness, moist tongue, not much acceleration of pulse, no increased heat, and frequently profuse salivation. Harles[14] supposed

1 Watson's Lectures, vol. ii.
2 Andral, Clinique Médicale.
3 Abercrombie, Pathol. and Pract. Researches.
4 Baillie's Morbid Anatomy.
5 Perceval, Trans. Col. Phys. Ireland, vol. ii.
6 Portal, Cours d'Anat. Médicale, tome v.
7 Tweedie, Library of Médecine.
8 Harles, Abhandlungen der Phys. Med. Soc. zu Erlangen.
9 Suppin, Journal de Médecine, vol. xii.
10 Casper's Wochenschrift, cited by Claessen.
11 Schmackpffefer, Observat. de quibusdam Pancreatis Morbis.
12 Lawrence, Med. Chir. Review, vol. xxi.
13 Andral, Clinique Médicale.
14 Harles, *op. cit.*

that a profuse perspiration or diarrhœa was critical in pancreatitis, but other authorities do not endorse this hypothesis.

An inexperienced observer might readily confound these symptoms with those of acute gastritis, but there is a very considerable difference between the two groups. In gastritis the pain is superficial; in pancreatis deep-seated; in the former, although severe, dull and heavy, and not increased by pressure; in the latter, more acute and much aggravated by pressure; with gastritis, there is not that peculiar restlessness which Claessen lays so much stress upon. Gastritis is accompanied by swelling; not so inflammation of the pancreas. The vomiting in gastritis is not so violent as during the former; neither is there the profuse discharge of fluid or salivation. In gastritis the tongue is dry, red-coated, and with aphthous spots; in pancreatitis little affected; with the former acceleration of pulse, in the latter none; and lastly purgatives and emetics aggravate gastritis, but do not increase the symptoms of the other affection.

Terminations.—Abercrombie [1] stated that inflammation might terminate in induration, suppuration, or gangrene; but I have not found any instance on record of the two latter states following acute inflammation.

Treatment.—Schmackpffefer [2] treated his case with calomel and opium, blood-letting, leeches, and purgatives. Lawrence's case was also subjected to depletory measures, and most authors advise the same. I have never happened to prescribe for acute inflammation of the pancreas, but most assuredly would not give mercury, as, by doing so, an already inflamed gland would be still more irritated, neither should I feel disposed to use depletory measures, to any great extent, remembering that there is little danger of the acute action terminating in suppuration. I think the indication of treatment would be to afford perfect *rest* to the inflamed part; and this would be best effected by eschewing mercurials, by bland diet, and by simple laxatives, as the sulphate of soda, to remove any fæcal collections. It would also be consistent with physiological principles, if what I have advanced be correct, to apply leeches, blisters, or fomentations to

[1] Abercrombie, on Dis. of Abdom. Viscera, Ed. Med. and Surg. Jour. 1823.
[2] Schmackpffefer, Obser. de quibusdam Pancreatis Morbis.

the regions of the salivary glands, and so endeavour to excite a metastasis of the inflammatory action to those sympathizing organs.

Chronic Inflammation, if not a sequel of acute, may, in its earlier stages, be unrecognizable, or it may be productive of that increased secretion, which has been described under the heads of exalted function and pyrosis. From this chronic hyperæmia the gland acquires hardness and density, and has been found, when death occurred from accident or other causes, infiltrated with red spots, and even blood.[1] Thus may arise either simple induration, hypertrophy, or, perhaps more generally, atrophy, the effect of interstitial deposit. These states, however, may commence and exist, without giving rise to any symptoms during life, or simply to those of dyspepsia already enumerated. Just as is the case with all other glands, so we find the pancreas present various degrees of size, softness, and hardness, within what may be expressed as its normal state. Thus Scholler[2] found induration of the organ in an infant of five days old, and it has been noticed by Copland,[3] Carter,[4] and others at all periods of life.[5] There are no specific symptoms by which we are able to diagnose the presence of chronic inflammation, induration, hypertrophy, softening, or atrophy, during life, no cases being on record where the three former were sufficient to cause any external appreciable protuberance.

Atrophy, besides being caused by interstitial deposit, may, according to Leibold and Lobstein,[6] occur as one of the results of advanced age, but it still more frequently happens from pressure of some adjacent diseased organ. Thus Dr. Hall[7] found atrophy from the pressure excited by a mesenteric tumour; Gendrin[8] gives a similar case; Morgagni[9] found it

1 Tweedie, Library of Medicine, Art. "Pancreas."
2 Scholler, quoted by Claessen.
3 Copland, Med. Dict., Art. "Pancreas."
4 Carter, Cyclop. of practical Medicine.
5 Abercrombie, Pathol. and Pract. Research.
6 Lobstein, Anat. Pathalog., tome i.
7 Tweedie, Library of Medicine.
8 Gendrin, Hist. Anat. des Inflam., tome i.
9 Morgagni, De Sed. et Caus. Morb., Epis. xxx.

produced by a tumour of the liver: Mondière[1] by a scirrhous pylorus: Berjaud[2] by an aortic aneurism: Pemberton[3] from obstruction of the duct by a calculus: Tweedie[4] from superficial deposit of fat, while the same condition has been connected by Claessen[5] with weak intellect, diminished *vis vitæ*, and depressed digestion. This author states, that, in persons so affected, the pancreas has been found so small, as to have led to a supposition that it was absent. It has also been found small in an individual who died from rabies, but this was most probably simply *post hoc* and not *propter hoc*.

Chronic Disease of the Pancreas.—Like those conditions just mentioned, the earlier stages of malignant disease, of abscess, of tubercular deposit, of calculous concretions, of serous cysts and hydatids, of fatty deposition, &c. are quite unmarked by any peculiar symptoms; but later in their progress, as already shown, the physician is enabled, in many instances, to establish a correct and satisfactory diagnosis.

All chronic pancreatic disease is accompanied by the following symptoms or signs, of course varying in intensity in individual cases :—

1. Local abdominal pain; 2. Abdominal swelling and sometimes pulsation; 3. Vomiting; 4. Thirst; 5. Alterations in the state of tongue; 6. Affections of the bowels; 7. Reflected affections of nervous system, as sleeplessness and restlessness; 8. Effects on nutrition; 9. Vicarious secretion of salivary glands and swelling of those organs; 10. Jaundice.

1. *Local Abdominal Pain.*—The nature of the pain is very variable, and may be either a dull weight at the epigastrium, tension and sensation of a weight suspended from the stomach,[6] or sensation of a heavy body sinking when the patient turns on one side. Sometimes the pain is acute and gnawing, and has been described by Claessen[7] as occasionally so agonising as to

[1] Mondière, Arch. Gén. de Méd., tome xii.

[2] Berjaud, Mém. de Méd. et Chirurg. Militar. tome x.

[3] Pemberton, Disorders of the Abdominal Viscera.

[4] Tweedie, *op cit.*

[5] Claessen, Die Krankheiten der Bauchspeicheldruse.

[6] James, Med. Dict., Art. "Pancreas."

[7] Claessen, Die Krankheiten der Bauchspeicheldruse.

cause temporary frenzy and a desire to tear the flesh. The weight is more felt when the patient is fasting.[1] The pain may be paroxysmal or continued,[2] and it is generally much increased by the act of vomiting.[3]

2. *Abdominal Swelling and Pulsation.*—The position of the swelling is very variable,[4] and it may extend in different directions; sometimes it appears as a tumour in the region of the stomach;[5] sometimes it presses upon and even perforates the diaphragm by absorption or ulceration;[6] occasionally it is only to be found by deep pressure;[7] often it induces oppression of breathing;[8] and it may either convey a sensation of hardness, of dull softness, or of boggy elasticity to the examining fingers.

Pulsation is not so frequently observed, but it has been noticed by Claessen[9] as occurring synchronously with the action of the heart; and in a case related by Dr. Battersby[10] it was attended by a *bruit de soufflet* which led to the opinion that there was an abdominal aneurism, but the autopsy revealed a cystic tumour of the pancreas. A loud *bruit* was heard in a case recorded by Dr. Leared, Medical Times, 1854.

3. *Vomiting.*—This symptom does not always appear at the same stage of the disorder; occasionally there is very considerable enlargement, but vomiting is absent. In some instances it assumes a very violent and formidable character, as in a case related by Störck[11] under the title of *hemorrhagia interna pancreatis.* It most frequently comes on in the morning, or two or three hours after meals. Sometimes blood is rejected, and in one instance so abundantly as to cause death.[12] It is, however, for the most

1 James, Med. Dict., Art. "Pancreas."

2 Carter, Cyclop. of Practical Medicine.

3 Abercrombie, Edin. Med. Surg. Jour., 1828.

4 Claessen, *op. cit.*

5 Tweedie, *op. cit.*

6 Miscellanea Curiosa Med.

7 Pemberton on Diseases of the Abdominal Viscera.

8 Alpinus, De Medicina Methodica, lib. vi.

9 Claessen, Die Krankheiten der Bauchspeicheldruse.

10 Battersby, Dub. Med. Journal, vol. 20.

11 Störck, quoted by Claessen.

12 Claessen, *op. cit.*

part a symptom of an advanced stage of the disease.[1] As already stated, vomiting always increases pain.[2] Pemberton[3] supposed this inverted action was due to suppression or increase of pancreatic secretion, but it is most likely caused by irritation of the stomach by the contiguous hard, rough, or swollen pancreas. It will be remembered, however, that some of Bernard's[4] dogs died from continued bilious vomiting after ligature of the duct.

4. *Thirst.*—This appears to be a pretty general symptom, particularly in the later stages; and we may perhaps refer it to the continued loss of watery fluid, either from the pancreas itself or from the salivary glands.

5. *Alterations in the state of the tongue.*—The tongue is very rarely coated during disease of the pancreas; and this fact possesses great interest as a diagnostic symptom, as in disease of the stomach, duodenum, and liver it is always altered.

6. *Affections of the bowels.*—Constipation would appear to be the most usual condition of the intestinal canal. Claessen[5] states this was present in thirty-two cases, while diarrhœa only occurred in twelve. Rahn[6] states there is generally hard, dry, fæcal evacuation. James[7] gives obstinate costiveness as a prominent symptom, excepting in the last stage when diarrhœa sets in. Pemberton[8] makes the same remarks; and in Dr. Leared's case before referred to, costiveness was present.

Objections have been taken in the first portion of this paper to the ingenious views advanced by Bright,[9] and the cases reported by that author and also by Elliotson[10] and Moyse[11] have been noticed. The former observed that almost complete destruction of the pancreas may exist without the occurrence of

1 *Op. cit.*
2 James, Med. Dict., Art. "Pancreas."
3 Pemberton, on Disease of Abdominal Viscera.
4 Bernard, Archiv. Gén. de Méd., No. xii.
5 Claessen, Die Krankheiten der Bauchspeicheldruse.
6 Rahn, Diagnosis Scirrhorum Pancreatis.
7 James, Med. Dictionary, Art. "Pancreas."
8 Pemberton, on the Diseases of the Abdominal Viscera.
9 Bright, Med. Chir. Trans., vol. xii.
10 Elliotson, Med. Chir. Trans., vol. xii.
11 Moyse, Historique sur les funct. du Pancreas.

fatty stools, and also, that he had never seen this phenomenon unless in connection with diseased pancreas. I have stated that I have observed the same appearance in the evacuations, when no suspicion of pancreatic disease existed; and in the discussions on this subject, it appears to have been forgotten that there is such an affection as "Diarrhœa adiposa," not common certainly, but still frequently met with and without any co-existent pancreatic affection. I believe the disease was first named "Diarrhœa adiposa" by Sauvages, and Dr. Elliotson refers to an example of it described by Tulpius, in which a woman discharged every day, for 14 months, a considerable quantity of yellow fat which lay upon the fæces like melted butter, the patient being during that time and for sixteen years afterwards, in excellent health and spirits. Watson [1] relates a similar case, in which he thinks the fat was secreted by a cyst in the liver, which was tender and dull on percussion. Dr. Prout also stated that a similar oily fluid has passed "*per urethram*," when the kidneys have been in a state of malignant disease. It would appear settled then that *this fatty material may occur in the evacuations, with or without pancreatic disease.* [2]

7. *Reflected affections of the Nervous System.*—Sleeplessness and restlessness. These are always more or less present, and are referred by Claessen to the deep-seated and parenchymatous structure of the organ, but this connection does not appear very rational. The older physicians, as Fernelius, Trew, Hoffmann, [3] and Riolanus, [4] supposed hysteria, epilepsy, hypochondriasis, and other nervous disorders had their seat in the pancreas, and it is probable that the latter may sometimes supervene on long continued dyspepsia arising from disease, functional or organic derangements of the organ.

8. *Effects on nutrition.*—Abercrombie [5] mentions cases where death occurred from pancreatic disease, and the body remained plump, and even contained an unusual amount of fat; but every

[1] Watson's Lectures, vol. ii.

[2] For instances, see Med. Chir. Review, vol. xx.

[3] Hoffmann, Dissert. de Pancreatis Morbis, 1713.

[4] James, Medical Dict., Art. "Pancreas."

[5] Abercrombie, Edin. Med. Surg. Journal, 1828.

other author on the subject,—Gregory,[1] Pemberton,[2] Hoffmann,[3] Rahn,[4] Portal,[5] Bedingfield,[6] Percival,[7] Crampton,[8] Harles,[9] Claessen,[10] James,[11] De Graaf,[12] Bonetus,[13] Carter,[14] Mondière,[15] Morgagni,[16] Schmackpffefer, &c.—all represent a peculiar cachexia as a very prominent symptom, and do not record any such instances as those referred to by the former authority, and this whether the disease existing was malignant or otherwise.

9. *Vicarious Secretion of the Salivary glands and swelling of those organs.*—Most of the authors just referred to also represent these phenomena as very universal, and prominent symptoms, and especially Wiechmann and Rahn.

10. *Jaundice.*—This is not so universally met with, but is mentioned by Claessen and Carter, and in cases detailed by Abercrombie,[17] Pemberton,[18] Roberts,[19] Fletcher,[20] Leared,[21] and others. In the absence of concomitant liver disease, this jaundiced condition would appear to be due to pressure exerted on the latter organ by the enlarged pancreas.

The last author named has drawn attention to peculiar crystals, somewhat resembling those of lithate of ammonia occurring

1 Gregory, Practice of Physic.
2 Pemberton, on the Diseases of Abdominal Viscera.
3 Hoffmann, *op. cit.*
4 Rahn, Diagnosis scirrhorum pancreatis.
5 Portal, Cours d'Anat. Médicale, tome v.
6 Bedingfield, Compendium of Med. Pract.
7 Percival, Inflam. and Enlarg. of the Pancreas, Trans. Col. Phys. vol. ii.
8 Crampton, Trans. Col. Phys. vol. ii.
9 Harles, Abhamlungen der Phys. Med. Soc. zu Erlangen.
10 Claessen, *op. cit.*
11 James, Med. Dic.
12 De Graaf, Tractatus, cap. vii.
13 Bonetus, De vomitu observat.
14 Carter, Cyclop. of pract. Medicine.
15 Mondière, Recherches, Archives Gén. de Méd., tome xii.
16 Morgagni De Sed. et Caus. Morbis, Epis. xxx.
17 Abercrombie, Edin. Med. Surg. Journal.
18 Pemberton, on the Diseases of the Abdominal Viscera.
19 Roberts, Lancet, 1846.
20 Fletcher, Trans. Birming. Mid. Counties Patholog. Soc. 1844.
21 Leared, Medical Times, 1854.

in alkaline urine, [1] which were found in the vomited material of an individual suffering from pancreatic disease. These crystals were examined by Queckett, who found them soluble in boiling æther, and hence considered them of fatty origin. A mixture of bile and pancreatic juice is stated to be requisite for the production of these crystals, but they are not of frequent occurrence, although similar appearances have been mentioned by Verdeil in his anatomical and pathological work, and also figured in the plates of Robin.

Now the affection with which chronic pancreatic disease is most likely to be confounded, is alteration of structure of the pyloric orifice of the stomach, and I shall therefore give a contrast of the symptoms and signs arising from both, which contrast will be found to present remarkable differences.

Chronic disease of Stomach.	*Chronic disease of Pancreas.*
Pain much increased by pressure.	Pain not so much increased by pressure.
Not great discharge of watery fluid.	Profuse discharge of watery fluid.
Tongue coated and aphthous.	Tongue generally clean.
Evacuation of bloody chocolate colored fluid.	No evacuation of, &c.
No swelling of salivary glands.	Swelling of salivary glands.
Cough.	Cough generally wanting.
Wasting not so great.	Wasting very great.
Purgatives aggravate.	Purgatives generally relieve.

It will be apparent that the diagnosis of chronic disease of the pancreas is not so difficult as some would lead us to suppose; and it now remains to enquire, if the specific disease which may be present can be foretold with any certainty; or, as Gregory stated, we can "only arrive at a plausible conjecture on the subject."

Of all chronic diseases of the organ, malignant is the most prevalent; and of malignant formations scirrhus is the one most usually met with. I do not think it is possible to foretell what

[1] Golding Bird, Plate 19, Waston, vol. ii., p. 276.

description of malignant disease may exist, but I imagine little difficulty would occur in diagnosing that some one of the cancerous degenerations were in progress; and as scirrhus is the one most commonly found, in any given case there would be strong reason for supposing it present. Other aids in forming an opinion would be *hereditary predisposition*, which Mr. Paget [1] found to exist in one-eighth of a certain number of cases, and is now allowed by all to have a slight influence in the production of cancer: *age*, malignant affections occurring most frequently between the periods of 45 and 60; [2] *the cancerous cachexia*, which is always sooner or later strongly marked: [3] and in some instances the formation of one or other of the malignant tumours in a more superficial part of the frame.

A very large number of cases of malignant disease of the pancreas might be quoted; and they sometimes attain an enormous magnitude: thus Riolanus found what he terms a scirrhus pancreas quite equal in size with the liver! but it may reasonably be doubted if this was a true scirrhus formation, as the latter never attains the size of the softer varieties, and the differences between the cancerous degenerations were not formerly so thoroughly understood as they are in the present day.

I have already stated that no case of simple hypertrophy is recorded as proving fatal, and I believe the diagnosis of this condition impossible during life.

Can Abscess be diagnosed?—I believe it may in many instances. I have seen one case of suppuration in the pancreas, and the formation of matter was indicated, as it often is in other parts, by the occurrence of severe rigors, with acute pain, afterwards becoming dull and heavy. The rigors in this case occurred daily for some ten days, and were followed by diarrhœa, sleeplessness, and hectic, under which the patient succumbed. A *post mortem* showed diffuse suppuration in the pancreas, and every other organ healthy. The individual had been long a sufferer from chronic dyspepsia, for which indeed he came into the Queen's Hospital.

1 Paget's Surgical Pathology.

2 Lawrence, 3. On Surgical Cancer.

3 Walsh, on Cancer.

Portal[1] observes that abscess of the pancreas is often concomitant with collections of matter in some other part, and instances the testicle as peculiarly liable. Tonelle[2] records two cases which occurred during puerperal peritonitis, which facts may prove useful as additional diagnostic aids.

I do not find any recorded case of circumscribed pancreatic abscess; the pus always appears to become infiltrated into the interlobular tissue. It may, however, be discharged during life, as was the case in a patient attended by Dr. Haygrath, pus having been found in the stools, and abscess in the pancreas, at the autopsy.

Are we enabled to diagnose tubercular deposit?—An enlargement, existing with hereditary scrofulous predisposition; or symptoms of tubercle in the lungs; or enlarged glands in the neck; or either variety of the scrofulous diathesis strongly marked in the personal appearance; the absence of cancerous cachexia; the presence of scrofulous disease of the joints or spine; and particularly a previous life spent in close, hot, dark, underground, unventilated apartments, would lead to a strong suspicion that such enlargement was tubercular.

Calculous Concretions. These may occur either in the substance[3] of the gland, or, as more usually happens, they form in the duct.[4] Their composition is identical with that of salivary calculi, being carbonate or phosphate of lime mixed with animal matter.[5] By the irritation they excite, or by plugging the duct, they bring on tumour, chronic inflammatory action or suppuration, but rarely attain to any great size.

Lobstein,[6] Dr. Garrod,[7] Carpenter,[8] and Canton,[9] have so decidedly traced the connection between the abuse of ardent spirits and the occurrence of calcareous and atheromatous

[1] Portal, Cours d'Anat. Médicale, tome v.
[2] Tonelle, quoted by Tweedie, Library of Med.
[3] Mondière, Arch. Gén. de Méd., tome xii.
[4] Gendrin, Hist. Anat. des Inflam., tome i.
[5] Portal, Cours d'Anat. Méd., tome v.
[6] Lobstein, Anat. Pathol., tome i.
[7] Garrod, Nature and Treatment of Gout, p. 246.
[8] Carpenter, on Alcoholic Liquors, p. 78.
[9] Canton, Lancet, June 1860.

deposits, that little doubt now remains on this subject. The very general coincidence of these depositions being found in the arteries of those individuals who have suffered from gout is another link in the chain. Hence, if an enlargement of the pancreas occurs in an individual who has a strong disposition to the lithic or phosphatic diathesis; who has abused the use of ardent spirits; who has suffered from attacks of gout; who has recognized concretions in the prostrate gland; who has the calcareo-atheromatous expression noticed by Dr. Gibb;[1] and who has not the symptoms or signs of scrofulous or cancerous disease; there is strong reason for pronouncing the origin of such pancreatic enlargement to be calcareous deposit.

Fatty Deposition.—There are two kinds of fatty deposition occurring in the pancreas, one being a simple deposition of the material between the lobes, the other being the true fatty degeneration or destruction of the proper tissue by the disease. It is the latter which is generally observed, and which, as Cruveilhier[2] remarks, cannot well be confounded with accumulation of fat in the laminous texture, which binds together the lobes and lobules. Cases of fatty pancreas are recorded by most of the authors before quoted, and it would appear to be by no means an unfrequent condition.

The peculiar state of constitution favourable to fatty degeneration is not far removed from the calcareo-atheromatous diathesis. Carpenter[3] states "attacks of arteritis seem not unfrequently traceable to alcoholic intoxication, and it cannot, therefore, be regarded as improbable that those more chronic disorders,—aneurism, softening fatty degeneration,—should be favoured, if not absolutely produced, by the habitual presence of alcohol in the circulating fluid." Paget[4] states the 'arcus senilis' is the most certain sign of fatty degeneration in the system. Canton[5] and Gibb[6] endorse this assertion, and the latter thus describes what

1 Gibb, Lancet, May 1860.
2 Cruveilhier, Pathol. Anat.
3 Carpenter, on Alcoholic Liquors, p. 78.
4 Paget, Lectures on Surgical Pathology.
5 Canton, Lancet, 1860, on Degeneration of the Arteries.
6 Gibb, Lancet, May 1860.

he styles the atheromatous or fatty expression:—"There will be noticed a peculiar greasy appearance of the face, especially about the prominent parts of the cheeks, and end of the nose. The lips have a fulness which is unmistakable; the ala of each nostril is smooth and rounded, while the features generally seem plump and well developed, because of the subcutaneous areolar structures being well supplied with adipose element: there is often a double chin of varying dimensions. The skin of the face may be reddish, or perhaps pinkish, with the small vessels on its surface injected here and there with blood of a bright red color, which extends in many cases to the tips and lobuli of the ears. The eyes are very bright, occasionally watery and of a fatty lustre, especially about the occular conjunctivæ. Once in a while, a well marked arcus adiposus, or arcus senilis will be seen, which may be a simple arcus or a complete annulus."

Therefore, I think, if we have enlargement of the pancreas, with the 'arcus senilis;' the atheromatous expression; a prior abuse of alcoholic liquors; an absence of the scrofulous and cancerous diathesis; no disposition to the lithic or phosphatic deposits; no gout and no calcareo-atheromatous expression (indicated by a *bluish white arcus, and a whiteness and pallor of countenance*); such pancreatic enlargement would probably be fatty.

Serous cysts and hydatids.—The occasional occurrence of these formations are undoubted, but nothing more than a plausible conjecture [1] can be formed as to their existence; and this supposition can only be arrived at negatively, in the absence of any signs and symptoms enumerated as diagnostic of other diseases.

The superficial deposit of lymph has been noticed by Claessen, Tweedie, and others, and the gland has been found atrophied from this cause so as to be almost invisible. There can be no means of diagnosing this condition.

Hemorrhage.—This has occurred in the gland to a very considerable extent. Störck found 13 pounds of coagulated blood in a sort of cyst which had formed in the interior of the organ. Hemorrhage generally occurs in the latter stages of malignant

[1] Gibb, Lancet, May 1860.

disease, and may, perhaps, be known by the sudden collapse, the feeble pulse, and the blanched appearance attending sudden losses of blood.

Simple induration, and *simple softening* of the gland cannot, I believe, be even presumed as present during life.

Gangrene.—The organ has been found sphacelated in a few cases, but I am unable to state how gangrene may be known previous to death. Perhaps the sudden absence of all pain occurring during disease of the pancreas, might give rise to a suspicion of mortification. Portal relates a case in his " Anat. Médicale," which appears to have been one of chronic inflammation, terminating, after 20 days, in gangrene, but the symptoms were too obscure to furnish grounds for diagnosis.

Complications.—Disease of the pancreas may be complicated with disease of the lungs, caused by pressure exerted on the base of that organ; with disease of the stomach, duodenum, and liver; these complications generally occurring in the progress of malignant disease, by extension of the diseased action to those parts, but the gall ducts may be obliterated by simple pressure from a non-malignant tumour; and stricture of the duodenum or even of the stomach itself may arise from the same cause. In some instances, as related by Abercrombie, the pancreas has been found to present a confused mass of disease, in which also the stomach, mesentery, liver, and duodenum were more or less involved. In such instances, all diagnostic endeavours must prove utterly valueless.

Treatment.—Pemberton stated "the remedies for a diseased pancreas are as imperfect as the symptoms which mark its derangement," and none of the authors I have quoted are enabled, either from experience or theory, to recommend any specific remedy. While, however, we attend to the general health, using those remedies which are indicated by the existing diathesis, and treating symptoms as they arise by palliatives and placebos, we must not be unmindful of the plan pursued by the older practitioners, which, from experience, I can state is not to be despised. When they met with cases in which pain of the stomach, or of some neighbouring viscus, was chiefly complained of, and when good evidence existed of actual disease

of any particular part, they gave "an opiate draught at bed-time and a common laxative in the morning."

I have now, I trust, in some degree demonstrated, that disease of the pancreas may in many instances be recognized, without a greater amount of difficulty than is presented by affections of other internal organs, and I sincerely wish my slight investigations of the pathology and physiology of the gland had enabled me to bring forward any method of treatment which might prove more successful than the usual practice. This, however, I am unable to do, with the exception of prohibiting the use of mercury. Most of the chronic diseases of the organ are but local manifestations of a constitutional or blood depravity ; and when the prevention of this is effected, either by medicine or, as seems more probable, by improved sanitary regulations and habits of life, then shall we be able to assume a victory over the local determinations of disease.

I am not, however, sufficiently utopian to imagine that disease will ever be eradicated from the human race ; for has not the Almighty said "Cursed is the ground for thy sake, in sorrow shalt thou eat of it all the days of thy life ?" but when I reflect on the advances our science has of late years made; when I consider that medicine has now allied herself with her younger sisters Hygiene and Sanitary Science; I do feel, that I am justified in supposing that the period is approaching, when every individual, who is not employed in an occupation inimical to human health; who uses without abusing the blessings he enjoys; who has the *mens sana in corpore sano* may, although

"There is a point
By nature fixed, whence life must downwards tend,"

recede from that point, into the green old age pourtrayed by Shakspeare "sans teeth, sans eyes, sans everything."

GENERAL TOPOGRAPHICAL AND MEDICAL ACCOUNT OF MOUNT ABOO.

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In Medical Charge Aboo Sanitarium.

Presented September 1860.

Geographical.—Mount Aboo is a large isolated mountain, in the territory of the Rao of Serohi; 45 miles N.E. from the military cantonment of Deesa, and to the S.W. of the Aravelli range, from which it appears to be distinct. It is situated in latitude 24° 40′ West, and in longitude 72° 56′ East.

Historical.—Its fame is of great antiquity, and pilgrims appear to have been attracted to its sacred temples since A. D. 1031. No notice was taken of it in our maps of India before the year 1806. Hindoo temples are said to have existed here in remote ages, dedicated to Siva and Vishnu; but all traces of them have disappeared. On their traditional site at Dilwarra, the famous Jain temples now stand built by Bimul Sah, a rich Jain merchant, and others; and the two principal temples are dedicated, respectively, to Richabdeo and Neminath. They are built almost entirely of marble, which must have been brought up the hill with much labour and expense from a quarry in the plains, on the Eastern aspect of Aboo. They are said to have cost 19 millions sterling. The internal carving and decorations are of the most elaborate, varied, and gorgeous description. A dirty half-ruined village is built all round, and approaches close to the outer walls of the temples. Other parts of the hill, and more especially the peak of Achilghur, have their peculiar history and traditionary legends. Remains of the rocky fastnesses of the Achilghur Chief of the olden time still exist, and the story of several Mussulmani inroads is still told to the curious traveller. The latter may still see the traces of the icono-

clastic fury of the followers of Mohammed. Aboo was formerly governed by the Chiefs of Chandrávati,—an extraordinary city about 10 miles from the base of Aboo, and the ruins of which are said to extend to an almost fabulous length, to this day. From this rule, Aboo passed into the hands of the chief of Meda, and from him it finally became transferred to the Raj of Serohi.

Discovery; Ascent.—Colonel Tod, the Governor General's Agent for the Western Provinces, was the first European who made the ascent of Aboo. He reached its highest summit in 1822, with considerable difficulty, and his grandiloquent remarks on what he saw are embodied in his large book called "Travels in Western India." Between 1824 and 1832 very few Europeans visited Aboo regularly, except the Political Superintendent of Serohi; but when the Joudhpoor Legion was formed, and the invigorating effect of the Aboo climate came to be known, houses began to be built, and the hill regularly visited by Europeans in the hot months.

Invalids sent up.—About 1840, the experiment was tried of sending up invalid soldiers from Deesa, for the sake of their health, during the hot months. They were generally encamped on the banks of the Aboo Lake. In 1843, a piece of ground was apportioned by the Rao for the hutting of the men. A hospital building, convalescent room, and two barrack huts were erected, partly at the recommendation of Colonel Sutherland, in 1847, who was strongly of opinion that Aboo should be made use of as a sanitarium throughout the whole year.

Descriptive.—The base of Mount Aboo is about 13 miles long, 11 broad, and 50 in circumference. It rises abruptly from the sandy plains, and the ascent is consequently steep and winding. The slopes of the hill are, generally speaking, covered with trees and shurbs; the intervening herbage affording pasturage during most parts of the year to the adventurous village cattle. The summit of the hill is very irregular; consisting of peaks, ridges, and valleys, sloping plateaux, and extensive basins.

Height.—The highest point is called Guru Sicker, and is 5,700 feet above the level of the sea. The average height of the station is 4,000 feet.

Landscape.—The general effect of the hill landscape is romantic and pleasing; the vigorous shrubs and herbage, blending agreeably with the bold and grotesquely shaped granite rocks. Streams of water flow along the low grounds and valleys; and here and there a small lake is left after the monsoon fall,—only dry during the hot months.

Ghauts.—There are many ghaut descents on different aspects of the hill; and here and there a deep gorge gives exit to the converging streamlets.

The Aboo Lake.—Some pains have been taken to embank and keep full one reservoir of water close to the station. This lake is called the Nukhee Talao. Originally scooped out, of modest dimensions, by supernatural hands (!), it has been enlarged to its present size, by the creation of a substantial bund. It is now about 1,000 yards long, and about half as broad. Its greatest depth under 40 feet. It is always filled up by the rains, and by the end of the hot weather falls 6 or 7 feet. The recession of the water, and the effect of a strong breeze, generally leaves on the leaward shore a belt of scum and offensive *débris*, which, to those living in the immediate vicinity, is anything but pleasant or sweet smelling. A little embanking at the shallow parts, so as at no season to leave any part of the bottom exposed, would probably remedy this evil. The weeds in the lake keep the water tolerably pure; and if the *Mahseer* or Indian Salmon was introduced, the result would probably be satisfactory.

Roads.—The station and its vicinity are supplied with roads, kept in repair for the most part at the expense of the residents. The Government provides the road up the hill, and those in the neighbourhood of the men's barracks. They are usually only gravelled paths. There are many cattle-tracks, bridle-paths, and narrow rocky walks all over the hill.

Game, &c.—The chief sport on Aboo is afforded by the Sambur deer, which abounds all over the hill. Cheetas and bears are also common enough, and the villagers are every now and then alarmed by the depredations of prowling tigers. On the lakes and swamps, in the cold weather, duck and teal are to be found; and in the hot months the beautiful jungle fowl and the spur fowl abound. The note of the cuckoo is first

heard in the month of May. Different kinds of snakes are always to be found. The lake contains several kinds of fish, some of which are tolerably good eating. The fresh-water crab abounds in some of the larger streams. Oxen, buffaloes, and goats are the only live stock generally kept by the villagers.

Geological.—Aboo is almost entirely composed of granite. Distinct veins of quartz are common, and trap, greenstone, and other rocks are occasionally met with. Fine specimens of rock crystal are sometimes picked up. The amygdaloidal structure may be observed in some of the rocks. The various stages of decay of the granite rocks is easily traceable. The marble of which the temples are made was brought up from the foot of the hill by an ancient and still partially existing road on the south-eastern aspect of the hill.

Villages.—There are twelve villages in Aboo, exclusive of the collections of houses which have sprung up in the vicinity of the station. Two villages are now deserted.

Aborigines.—The aborigines of the hill appear to have been a sort of Bheels. They seem at some time or other to have become mixed with marauding Rajpoots from the plains, and with the workmen who were so long engaged in building the Dilwarra temples. This mixed race call themselves Loke, and are now in possession of almost all the land under cultivation.

Population.—The Hindoo population probably exceeds 1,000, exclusive of the followers of Political Agents and Vakeels. The castes are chiefly Jains, Rajpoots, Coolies, Bheels, and Lokes. The Mussulmans met with on Aboo are followers of the Rajpootana Agency or pensioners.

Cultivation.—Cultivation is naturally limited, and is confined generally to the low strips of valley land in the vicinity of the villages and streams.

Irrigation.—Irrigation is carried on by means of the *Aret* or Egyptian wheel.

Crops.—The only crops are wheat and barley in the cold weather, and in the rains, maize and a few species of cucumbers and gourds.

Vegetables.—Potatoes and European vegetables generally thrive well on the hill.

Tea.—The tea plant some years ago was, for a time, cultivated with success, but unfortunately the Rao transferred the plants to his own garden in Serohi, where they naturally perished.

Fruit, &c.—Mangoes are plentiful, but of an inferior quality. From the branches of the mango tree is often seen hanging the *Ambatri*, an elegant flowering parasite. Plantains thrive, but the fruit does not come to perfection. The karoonda plant (the *Carissa carandas*) grows wild and is plentiful and vigorous. An excellent and wholesome jelly is made from the berries.

Different plants.—The jessamine, the oleander, the willow, and the dog rose are abundantly met with. The apricot and nectarine, the grape, the pomegranate, and citron are claimed as indigenous in Aboo. The sacred golden champa tree grows at Dilwarra and other parts of the hill to a considerable size. The delightful fragrance and umbrageous beauty of this magnificent tree are very striking. English flowers grow well in the gardens.

Soil.—The soil is porous in the higher grounds; but the black soil of the lower parts is very tenacious of moisture. It is composed chiefly of the different kinds of clay and gravel, mixed with decayed vegetable matter. In some parts of the hill two crops are raised yearly. Wild flowers are abundant, and honey is a favourite food among the villagers. There is a small trade carried on in bees' wax, the honey being drained off in small earthern pots.

Grass.—The grass is not of very good quality for fattening cattle or horses. A sort of strong high grass called *mooyah*, and used for chuppering houses, springs up in tufts most luxuriantly wherever there is dampness or moisture, and its presence is a pretty sure sign of the necessity of draining the ground on which it grows.

The Seasons.—The seasons are divided, as in the plains, into the cold, the hot, and the rains. The hot season commences about the middle of April, and terminates with the rains some time in June. The rains begin and end with slight thunderstorms, and cease about the middle of September. A short season of warm weather, with occasional showers, fills up the

interval between the wet and cold seasons. Towards the middle or the end of November, the cold weather begins, and continues until April.

Temperature.—The temperature in the hot months in the shade, seldom exceeds 90° but has been known to rise to 98°. The lowest point to which the thermometer has fallen is 28°, but in most cold seasons it rarely falls below 40°. Taking the usual extremes of 40° and 90°, the table below will show the range and the comparison with the Deesa readings. During April, May, and June, the weather is most delightful and healthy; and the temperature in the middle of the day in the shade is never what can be called oppressive. The nights are cool and well suited for refreshing sleep. Kuskus tatties are unknown, and punkahs are seldom employed. The average summer temperature is 77°; the corresponding Deesa average being 90°, as will be seen by the accompanying table:—

	Usual extreme of Summer heat in shade.	Usual extreme of Winter cold in shade.	Average daily Temperature throughout the year in shade.	Maximum Temperature in Sun's rays	Usual range of Thermometer.
Deesa	110°	40°	74·1°	147·7°	70°
Aboo	90	40	69·9	112·9	50

The Monsoon.—Generally speaking, hill stations in the wet months are disagreeable to live in, but Aboo appears to me to be an exception to this rule. The rain-fall in the plains round about is so scanty, and the heat so close, damp, and unhealthy, that Aboo is, in the monsoon, a most valuable and desirable retreat from the trying climate below. It cannot be said to be an agreeable season for the soldiers, because their out-door exercises and amusements are interrupted; and because, as will be fully afterwards stated, their barracks are badly situated and unfitted by their temporary and leaky construction for a monsoon residence. Yet, notwithstanding these drawbacks, the men are always healthy during the rainy weather. It will easily be understood how, in this respect, the

Aboo hill climate differs from the Deccan and Himalayan Sanitaria, to which there is much less necessity in the rains for drafting sick troops than exists in Guzerat. This remark especially applies to the Deccan, in which the monsoon season is mild, genial, and healthy. Again, the rain-fall at most other sanitaria is excessive ; while, by a reference to the following table, it will be seen that at Aboo it is extremely moderate :—

	Average annual Rain fall.
Aboo	55·0 inches.
Deesa	25·0 "
Bombay	75·0 "
Mahableshwar	254·0 "
Poorundhur	72·2 "

The average monsoon temperature at Deesa is 89°, while the mercury averages a height of only 70° at Aboo. The climate here during the monsoon is soft and pleasant; but there are the drawbacks, of course, of fog, drizzle, and wet walking. There is almost always great humidity in the air ; and exposed furniture and other articles become rapidly covered with mould. From 55 to 60 inches of rain is the usual annual fall, although, for the last 5 years, the unusually high average of 69 inches 29 cents has been attained. The penetrating, driving, drizzle which sometimes occurs, requires a particular construction of building to resist and exclude. There are occasionally fine days throughout the wet weather, which seldom remains without interruption for more than five days at a time.

Drying-up period.—After the rains, the usual season of autumnal heat succeeds, and the drying-up of the wet ground begins. The high ground and hilly tracts are soon drained of their moisture; but the valleys, and low grounds, receiving the drainage of the higher ground on all sides, remain moist up to about the end of the year. They are also covered up to a late period of the year with constant morning mists. The soldiers live in such a valley, and suffer at this season in consequence from malarious diseases.

Cold Season.—The cold weather after December is very healthy and bracing; the temperature averaging about 60°. Hoar-frost often covers the grass in the morning before sunrise; and some years ago ice used to be made and stored. From the 1st of January downwards, this season appears to be healthier than any other.

Selection of Station.—In the selection of an European station at Aboo, the present site was naturally fixed on, on account of its romantic position on the banks of the lake; the adaptability of the undulating ground to the purposes of building, and for gardens; and its convenient nearness to the Deesa road and to the chief objects of interest on the hill. It would certainly be fixed on as one of *two* positions to be found on Aboo, which appear to be well adapted for the purposes of a station.

Site of Ooria.—The other tract of ground appears to be in many respects still more advantageous than the presently occupied site. It is a large piece of table-land called *Ooria*, and it is situated on the Western aspect, and at the foot of the high peak of Gurusicker. It is nearly five miles distant in an Easterly direction from the station; and 500 feet higher than the latter. It would probably afford scope for the hutting and exercising of two or three thousand men. The ascent to it, at present, is steep and difficult, but it would not be a very laborious task to make a good road. The ancient road from the marble quarry at the bottom of the hill might be repaired and made use of as an immediate method of access from the plains to Ooria. Undulating bungalow and garden ground is plentiful at this part of the hill. On its south side, a certain amount of drainage would be necessary. In a few years, when it comes to be seen, more than it seems to be at present, that hill stations of a particular altitude and favourable climatic qualities are the natural and providential residences, when practicable, of Europeans in this country (with a few exceptions), and more especially for the young and weakly, I can imagine that motives, both of humanity and financial economy, may induce the Government to form an extensive Depôt or Depôt Brigade of Troops, and especially of young and recently arrived soldiers at Aboo, for the supply of surrounding stations. In that case, the plateau or table-land of

Ooria might be employed with advantage, and the position more minutely studied. With a line of railway to Deesa, Ahmedabad, Nusseerabad, and Neemuch, it would be possible and desirable to concentrate the European troops at Aboo, leaving the smallest possible number of European soldiers at these stations. To adduce no higher considerations, the expense of the invaliding and discharge of broken-down soldiers from Guzerat and Rajpootana, now so great, would, I conceive, be most materially lessened by such an arrangement.

Road from Deesa.—The present road from Deesa to Aboo is little more than a cart tract over the sand, dusty and heavy in dry weather, and intersected by numerous streams and difficult of passage in the rains. Travelling by stages, of which there are four intermediate ones on the road, it is a dreary journey, but in dry weather, with good means of conveyance, it may be hurried over in a single night. A railway at the Indian rate of speed, would draft invalids from Deesa to Aboo in 2⅔ hours. About two miles from the foot of the hill, is the little village of Anadra, where troops and visitors usually halt to procure cooly carriage and chairs for the ascent. The road, from the foot of the hill upwards, is a steep zigzag path, on which two men can walk abreast. The Engineer of Aboo states that there are no engineering difficulties in the way of making a good carriage road up the hill. The top of the hill is reached at what is called the *Aboo Gates*, which are merely two prominent perpendicular rocks, between which the road passes. Proceeding along this road 200 or 300 yards further, the first glimpse of the Aboo Lake is afforded, and shortly afterwards, the road winds through the station.

The Station.—The station of Mount Aboo is situated in a sort of basin formed by the Northern and Western ridges of the hill on two sides, and by the smaller peaks and detached ridges on the South and East. The station is about 4,000 feet above the sea, and the ridges round about rise to a height of from 400 to 1,000 feet higher. The basin may be said to be about 3¼ miles long, and 2 miles broad, irregular in outline, and communicating by several gorges and ghaut paths with the plains below.

Bungalows.—There are about 20 bungalows in the station belonging to residents, or rented by visitors. They are generally built on rising ground, and there is perhaps a difference of 150 feet in the height of the highest and lowest bungalow. The depressions and valleys are usually avoided for building purposes, as they are damp and unwholesome to live in, but they have hitherto been thought good enough for the soldiers' barracks.

The Church, &c.—A small, airy, strongly-built iron-roofed Church stands near the centre of the station, and a few yards from it the extensive buildings of the Aboo Lawrence School are placed. The Deesa Chaplain makes a visit about once a month when the roads are practicable.

Bazars.—There is a large bazar near the Church on low ground, which presents few features of interest; and there is a smaller one attached to the Sanitarium and within the military limits. The means and supervision for insuring cleanliness in both the bazars appear, from the results, to be inadequate. Almost all supplies come from below on the heads of coolies, and on the backs of donkeys, and are retailed in the bazars at considerably advanced prices.

Cemetery.—There is a prettily situated cemetery within a mile of the Church, in a westerly direction.

Number of Europeans.—There are generally from 200 to 300 Europeans on the hill, including the Lawrence School children and soldiers.

Objects of Interest.—The chief objects of interest or excursion in Aboo, are the Cannibal's cave; the Dilwarra temples; the Achilghur hill, lake, and temple; the shrine of Achileshwar; the plateau of Ooria; the high pinnacle of Guru Sicker; the ancient road from the marble quarries; the Gaimuck descent, well, and temple; with the various surrounding peaks and hill-tops.

Political, &c.—The hill of Aboo, is owned by the Rao of Serohi, who, at first with some difficulty, was induced to approve of the sacred ground of Aboo being used as a station for European residents and soldiers. The strictness of the Rajpootana treaties has hitherto prevented the slaughter of oxen at Aboo, there being no military cantonment there, properly so

called. Since the time of Sir Henry Lawrence, Aboo has been the head quarters of the Governor General's Agent for Rajpootana; who, with his staff and numerous followers, remain at Aboo during the hot months and part of the rains. The Political Superintendent of Serohi is the Magistrate of Aboo, and remains for most part of the year on the hill. A few of the foot soldiers of the Erinpoorah Irregular Force remain on the hill as a guard for the prisoners, who are made useful on the roads and in the gardens.

Schools, Aboo Lawrence School.—There is no native school at Aboo. There is a very flourishing establishment for the education of the children of European soldiers, and others; founded and endowed by the late Sir Henry Lawrence. It is called the Aboo Lawrence School. It has already proved an incalculable blessing to many children, who would otherwise have been exposed to the deadly influence of a residence in the plains and the baneful example of a barrack-life. It is now chiefly supported by voluntary subscription, with a small monthly allowance from Government. The number of children varies from 40 to 70. Their happy and healthy appearance is the subject of remark of all visitors. The boys are provided with situations in the Civil, Staff, and subordinate Medical Departments; and the girls are trained to be useful wives and members of society. In the difficult problem of the colonization and civilization of India, it is surely impossible to overrate the importance of an institution like this. The constant influx into the middle ranks of the European society in India, of well brought up and educated youths whose expectations and hopes do not reach beyond the limits of the country, is an element of strength, which it would be well to develope and employ.

Hill Stations.—It appears in this age of advanced sanitary ideas, that hill stations are beginning to occupy a larger share of attention than formerly. Till within the last 3 or 4 years, India has been in a certain sense little known in England. Especially has very little information been collected and made public on the subject of European soldiers in the East, nor has much interest been taken apparently in such questions of vital interest as their diet, dress, barrack and hospital accommodation, their exercises and

amusements. Statistics, the accuracy of which cannot be questioned, show that every $13\frac{1}{2}$ years the European Army in India disappears entirely from the country; and also, no less surely, that more than two-thirds of this mortality arise from preventible disease; nay, almost altogether from the effects direct or indirect of malarious poisoning. Such an enormous mortality appears to call for an explanation with a view to arriving at rational modes of prevention. Sir R. Martin, has brought forward several excellent suggestions on this subject, and among others has directed particular attention to the hill climates of India, which he says remove the European above the range of the malarious fevers of India; he is more particularly of opinion that the solitary hills have advantages over the more extensive mountain-ranges, peculiar to themselves. In adapting the benefits of hill sanitaria to invalids, it appears certain that considerable judgment is necessary. For men not suffering from organic disease, they seem, under proper sanitary conditions, to be extremely suitable and advantageous. It is quite clear that, to a certain extent, and in particular places, sources of malaria exist on the hills as well as in the plains; and if men arrive at a hill station possessing the malarious taint, and consequent proclivity to periodic fevers and organic congestions, these latter forms of disease will assuredly be stirred into activity by a fresh exposure to even a small amount of malaria at the hill sanitaria to which they are sent. It is therefore of infinite importance that thorough sanitary measures should be adopted at hill stations as well as in the plains, that their benefits may not be neutralized. If such a thing as acclimatization exists, it will certainly be found to be secured by a year or two's residence on a hill climate, very soon after arrival in India. As far as our limited experience as yet extends, it seems undesirable to remove *en masse* a service-worn European Regiment, which has been several years in India, to the hills. Visceral congestions are likely to occur in a proportion of the men. It is in the freshly arrived drafts and regiments, with special reference to young recruits, that benefit is to be looked for. The hill stations, without doubt, are admirably adapted for the acclimatization of newly arrived Europeans, especially for young soldiers under

the age of 22; for the complete restoration of convalescents from many forms of disease; and in a striking degree for the rearing of European children. Financially speaking, there would certainly result a great money gain to the Government in the diminution of invaliding, transport, and recruiting expenses.

The Climate, &c.—Aboo occupies a favourable position among Indian hill sanitaria. It is central among the sultry and unhealthy stations of Guzerat and Rajpootana; its climate is agreeable and salubrious; there are no hot winds; there are no violent storms; there have never been accidents from lightning; the rain-fall is moderate, for it does not equal that of the island of Bombay; the place is not blocked up with snow, as in some other sanitaria in the cold weather; there are facilities for making good roads up and on the hill; the soil is, except in the very low grounds, porous and easily drained; the water is pretty good when filtered, and abundant; English fruits and vegetables grow vigorously, and there are facilities for boating, shooting, cricketing, and other amusements seldom combined in one station. The Aboo climate appears well adapted to the European constitution. Children especially thrive most vigorously, and have an English colour and firmness of muscle. Recruits and young soldiers sent up drooping and weakly from the debilitating effects of the Deesa heat, soon put on flesh and colour. The effect of the heat on young soldiers especially, is well-marked on the Guzerat plains. Deesa statistics of health appear favourable on paper, but the men, though not actually suffering from disease, after some time, become pale and dried-up looking, fall out often on parade, and become faint from exertion of any kind; and, moreover, become predisposed to the effects of exposure, sun-stroke, drink, and epidemics. If the troops, instead of at once settling down under these enervating conditions, were collected at Aboo, and kept there for a year or two after their arrival, they might be paraded and drilled morning and night, without fear of overworking or distressing them. As comparitively strong and drilled soldiers, they could then be sent to do duty at those stations in the plains, where it was considered an absolute necessity for European soldiers to be. The constitution of the soldiers would thus be preserved from the malarious

taint, which a large number of them acquire during their first two or three years residence, and which afterwards very slight causes are sufficient to stir into activity.

Aboo for Invalids.—As a Sanitarium for Invalids, the Aboo climate during most part of the year is well adapted for a selection of cases. The most beneficial season for a change to Aboo is the hot weather. The monsoon weather at Aboo being cool and mild, is also adapted to many cases that droop and sink in the hot monsoon of the plains. The winter months from December to March are very healthy to most men, but should be avoided by those suffering from any organic visceral disease, lung affections, syphilitic or rheumatic weakness.

Sanitary defects, &c.—In the present sanitary state of Aboo, no men should be sent up from the plains in October, November, or December. With a disregard of the first principles of health, the barracks have been built in a low valley with all the elements of malarious generation rife at hand. Until the drying-up process begins towards the middle of October the paludal poison does not appear to be called into activity, and the miasm appears to have cleared away by the time of the new year.

Cases that do not benefit.—The following forms of disease, with occasional exceptions, do not appear to receive benefit from a change to Aboo:—

1*st.* Idiopathic rheumatism; acute and chronic. Patients suffering from this complaint, may receive a slight benefit in April, May, and June; but during the other months they ought not to be sent up the hill.

2*nd.* The same remarks apply in a still stronger degree to the different forms of secondary syphilis.

3*rd.* Hepatic complaints. Patients quite convalescent from this disease will probably gain strength by a fortnight or a month's change during the very warm months; but by no means should patients actually suffering from hepatic disease be sent to Aboo during any part of the year, or kept on the hill after it has broken out.

4*th.* Heart diseases.

5*th.* Pulmonary complaints.

Patients under the 4th and 5th classes receive benefit only in their general health at certain stages of their malady. The rarity of the air appears to give the lungs more work to do in a given time; and most assuredly phthisical cases in the later stages are hurried on to their end.

Cases that are benefitted.—On the other hand, benefit is to be derived from the change, in the following diseases:—

1*st.* Intermittent fever. Here the effect is striking. The paroxysms abate in frequency and strength, and the debilitated patient almost invariably puts on flesh and colour. But so long as the sanitary conditions of an Aboo residence are disregarded as at present, I would strongly advise that, during the months of October, November, and December, no fever cases should be sent to Aboo. Indeed as many men as possible should, during this season, be sent back to the plains.

2*nd.* Dyspepsia (idiopathic) receives much benefit.

3*rd.* Chronic and obstinate ophthalmia the same.

4*th.* Ulcers and discharges will receive marked benefit.

5*th.* Diarrhœa. Patients will almost always be cured by the change. There is no such thing as *hill diarrhœa,* as met with in some of the Sub-Himalayan hill stations.

6*th.* Dysentery. Patients so affected will receive a moderate amount of benefit, especially during the hot months and in the monsoon, and after slow and lingering convalesence.

Exercise.—There is at Aboo a tendency to biliousness and headache amongst a good many of the residents and soldiers, and the habit of constant brisk daily exercise is very necessary to keep the skin and liver in good working order.

Epidemics.—Now and then an epidemic of small-pox passes over the hill, but no case of cholera has been ever known, except in individuals lately arrived from the plains where it has been raging. The natives of Aboo are not a very strong or muscular race, and suffer a good deal in the wet and cold seasons from periodic fever, rheumatism, and other diseases. There are not very many old people to be seen. It is difficult to introduce vaccination amongst them, and the late small-pox epidemic was very severe on the village children. The anæsthetic leprosy is not unfrequent

amongst them, and affections of the eyes, perhaps a good deal from dirt and inattention, are common enough.

The Barracks, &c.—There are two barrack-huts at Aboo, intended to accommodate 60 men each, but certainly not fitted for more than 40 men each; and there is a patcherry, temporarily occupied as a hospital, and fitted to contain about 40 patients. The two first-named barrack-huts are built in a valley near the west end of the lake. This valley is about one-third of a mile long and runs in a direction from W. to E. nearly. It is the channel by which, in the monsoon, a large quantity of the rain that falls on the surrounding hills finds its way to the lake. It is flanked on both sides by hills, some of which rise to a height of 150 feet. The lake is 350 yards distant from the barracks, and at the point where the valley meets the lake, the banks are shallow and marshy. The aspects of the two barrack buildings are respectively S. S. E. and N. The original intention, which was that the soldiers might be well out of sight, and out of the way of visitors and residents when the latter went out to walk or ride, appears to have been well fulfilled. There is not much breeze over the barracks, except what comes up—sometimes not very savoury—from the direction of the lake. The barracks are, what is called by some wise old authorities, nicely sheltered and defended against the bleak and cutting winds of this cold region. I believe, generally speaking, that this sheltering from bleak winds, is just another name for deficient external ventilation, which is of much more consequence to secure than any imaginary immunity from draughts. The soil of the valley is soft and marshy, and requires a good deal of drainage to keep it tolerably dry. In digging and deepening the drain-trenches in the comparatively dry weather, I have particularly remarked the soil thrown up to be wet and heavy. It would make a very good place to grow vegetables. In the cool months, the valley air feels cold and raw, while the feeling on the higher ground round about, which is warmed and ventilated by the early rays of the sun, is fresh and exhilarating. This site has been occupied by soldiers since 1843; and so lately as 1858, two new barrack buildings were actually built in the same place to replace two old condemned ones. There

have been committees without number; and though every one and Government also appear to be agreed on the necessity of a removal to a new site, there seems little prospect of an early change. I should be afraid to speculate on the amount of benefit to European invalid soldiers which has been thrown away or rendered nugatory by about the worst position in Aboo being occupied as their residence. About the same distance from the church as the present barrack site, the moderately-sized plateau of Gundermuck offers almost every advantage as a site, except extensive exercising ground, and that is to be had in but very few places on the hill. There is an immediate fall from it on all sides, which secures dryness and successful carrying off of drainage water. There is facility for well-sinking all about the place. There is no hill or intervening object to shut out the breeze. At one end there is an excellent airy position for a hospital, and lower sloping ground to leeward for cook-houses, latrines, bazars, and followers. Like every other position chosen for a site, it would require a certain amount of drainage. This site was recommended some years back, and has been approved of by Government.

The two barrack huts before alluded to are situated in the centre or broadest part of the above-described valley, are 183 yards apart, and both have aspects nearly N. and S. They are long-tiled huts of wattle and dab, with a broad verandah on each side. The barrack-room runs the whole length of the building without interval or partition. The ends of the verandahs are walled up into little rooms, used as non-commissioned officers' and married people's quarters, canteen, and store-room. The barrack is 18 feet high in the centre ridge, 103 feet long, and 21½ feet broad. The verandah gives an additional breadth of 11½ feet on each side. There are 14 windows and 4 doors. There are three ventilators of clumsy impracticable construction on the roof of one barrack, and none at all on the other. The barracks are built on a somewhat raised foundation. Each barrack contains 33,790 cubic feet of space, and I think should not accommodate more than 34 men. They are built by the engineer to hold 60 men. If the engineer's allotment was carried out, each

occupant would have only 563 cubic feet of air. Under the same arrangement each man would have a surface space of only $36\frac{1}{2}$ square feet. Certainly, considering the porous construction of the walls and roof, and the number of windows and doors that can be opened, amounting to one-tenth of the whole wall superficies, it must be admitted that the apparent allowance of cubic space shows more unfavourably than is actually the case, the breathing space allotted to each man. The floors are of beaten earth, cowdunged four times a month. What with this damp and dirty floor, and the porous wattle and dab walls, it may be conceived how difficult it is for the men to keep their clothes and bedding dry in the monsoon. Within two or three yards from each barrack is a chuppered grass bath-room, where a cask of fresh water is always kept for drinking and washing purposes, and a tub lies filled for bathers. At the other end of this chupper house is a chunam ledge used as a urinal. There are good necessaries and cook-rooms all pucka built, and one of each to each barrack. A work-shop has also lately been built, but is too small to be of much use. There is a guard-room, cell, and soldiers' library,—all of the most dwarfed construction. Under two temporary sheds the Commissariat casks, provisions, and office are sheltered. They are much too close to one of the barrack huts. There is no regular hospital at present, the old one having been pronounced unsafe in July 1859. A patchery, which had just been finished for married soldiers' quarters, was then taken into use as a hospital, and has so remained up to this time. It is 425 yards distant from the barracks, and 70 or 80 feet higher than the latter. Considerable inconvenience has been occasioned by this temporary occupation of an unsuitable building. There was originally no necessary, no quarters for the apothecary, hospital serjeant, surgery, medicines, stores, or anything else. The patchery is a long tiled building something like the barracks. It is surrounded with a verandah 8 feet wide. The building itself is 150 feet long, 20 feet high at the centre ridge, and $39\frac{1}{2}$ feet wide, including the verandahs, aspect N. and S. It was found necessary to partition off at each end small rooms for the use of the medical subordinate, surgery, medical stores, hospital serjeant, hospital guard, and dead-room.

The hospital-room proper was thus curtailed to a length of 98 feet. This gives a cubic space of 34,545 cubic feet, or ample room for 30 patients, who would each have over 1,100 feet of breathing space. Each would also at this rate enjoy a territory of 76½ square feet. The verandah roof does not run down flush with the roof of the building, but comes off about 2 feet below the eaves of the latter. This intervening space of the side wall is devoted to ventilation. Instead of being walled up, it is filled in with bamboo lattice-work. In wet weather this is an objectionable mode of ventilation, as the rain drives freely through the interstices. So it has been closed up at that time of the year when there is, perhaps, more necessity for roof ventilation than in the fine weather, when the doors and windows are always open. There are five small bath-rooms outside the building under one roof, and a good cook-house. There is a temporary necessary made of grass tatties, 10 yards to leeward of the hospital, and approached by a covered way. There is a well 300 yards from the barracks, of pretty good water, which, however, at some seasons becomes thick and muddy, and requires to be passed through a chatty-filter arrangement before it is palatable. There is also a well near the hospital.

Aboo water.—The water at Aboo is, I believe, chiefly supplied to the different wells by percolation from the lake, except in the wet weather, when the drainage of surrounding high ground finds its way into these reservoirs. Some of the wells are much better than others, but in none of them is the water of *very* excellent quality, although by filtration it can be made tolerably good and pure. I believe its usual contamination to be vegetable matters. Natives who come up from the plains complain of it as the "heavy hill water." I think it has something to do with the bad health which the majority of them more or less experience shortly after their arrival from below.

Garrison.—Aboo, up to the time of the mutiny, in 1857, was used for sick and convalescents only, but since that time, in addition to these, a detachment of 80 men has been stationed there. The invalids, when discharged from the convalescent list, have always taken their share of the regular duties. It is much to

be regretted that the sick of the detachment have always been treated in the Sanitarium hospital, and included without distinction in the same returns as the arrivals for change of air. This has been lately obviated by a very proper order from the chief medical authority of the division. The number of invalids generally present at Aboo for change of air, varies from 30 to 100, and is chiefly composed of men sent from Deesa and Nusseerabad. It seems desirable that the Neemuch and Ahmedabad troops should also enjoy the advantage of a change to Aboo; but from the distance, or some other cause, none have as yet arrived.

Aboo Staff.—The Aboo Sanitarium is commanded by a Captain, who usually belongs to the European Regiment at Deesa, and who holds his appointment for two years, except in the event of his Regiment being removed from the Bombay Presidency. The medical charge of the Sanitarium is held by an Assistant Surgeon of the Home Army, on the same conditions as the Commandant.* The Non-Commissioned staff comprehends a Serjeant Major, a Hospital Serjeant, a Canteen Serjeant, and Writer. Invalids not belonging to the same regiment as the garrisoning company, are, when unaccompanied by an officer, paid and looked after by the commandant.

Duty.—The duties are light. There are three guards—barrack, hospital, and ammunition; putting twelve privates and four non-commissioned officers on guard daily. The men have thus from five to eight nights in bed generally speaking. During the monsoon, the hospital guard is sometimes discontinued.

Diet.—The diet of the men, such as it is, is generally good:—the daily ration to each man is 1 lb. of fresh mutton. The strict treaties on the subject of killing oxen and cows do not admit of a change in the meat ration; but I am informed by the Governor General's Agent for Rajpootana, that he is about to make an attempt to prevail upon the native authorities to allow oxen to be slaughtered on the hill. This would be a great boon, not only as a change of diet, but for Hospital purposes. The mutton ration is generally good, and this also, as well as the other rations, is inspected daily by an officer. Now and then a

* These arrangements are not now in force.—*Ed.* 1861.

ration of salt beef or pork is substituted for the mutton. The men have their meat cooked according to their own liking. Each man has 1 lb. of good bread, 4 ozs. rice, and 1 lb. of vegetables, of which $\frac{1}{3}$ is generally onions, and the other $\frac{2}{3}$ potatoes, sweet potatoes, or pumpkins, as the season of the year permits. Salt, tea, and sugar, are provided in usual and sufficient quantity.

Liquor.—Above one half the men drink their daily quart of porter, and one third of the men have been arrack drinkers. Many of the men who drink the arrack, I feel sure would confine themselves to the malt liquor, had they not acquired the habit of spirit drinking on the different lines of march; where a half compulsory system of arrack issue is adopted. Afterwards when in quarters, they do not care to struggle against the habit. They have not much difficulty at Aboo in procuring also the poisonous native liquor; but I am certain that not nearly so much drinking takes place among the men at Aboo, as if they were in the plains with their Head Quarters.

Number treated.—During the year ending 31st March 1860, 159 weakly men have been sent up to Aboo for change of air. Of these, 5 have died; 12 have received little or no benefit, and have been sent back to their regiments to be invalided or otherwise disposed off; and 53, having quite recovered, have rejoined their respective head quarters. During the year there have been in addition present at Aboo 80 duty men, and the sick of both classes have been treated indiscriminately in one hospital. This, as before remarked, is to be regretted, as the returns do not consequently show with accuracy the effects of the climate on the weakly. 284. cases of disease, exclusive of officers, have been treated in hospital during the twelve months; of which number, 7 have died, 12 have been transferred not benefitted, 265 have been cured, and 8 remain in hospital under treatment.

Out of this total of 284 cases treated, no fewer than 236 come under the head of zymotic disease. Of the 7 deaths, 3 were from zymotic complaints. Need I add that the diseases of the zymotic class were almost all of the miasmatic order, and the vast majority of them of periodic fever and its sequelæ. Mortality per-centages and other particulars will be best considered in the tabular form which is annexed.

That invalids and convalescents from disease may reap the full benefit of the change to Aboo, it is necessary that the following particulars should be attended to:—

1*st.*—The selection of the invalids or the weakly men to be sent up should be carefully made by the medical officers of their corps; and no man suffering from advanced lung affection or asthma, liver or heart disease, chronic or syphilitic rheumatism, or the syphilitic cachexy, should be sent up, except under very particular circumstances, in the hot months.

2*nd.*—No soldier, sick or well, as long as the barracks are situated where they are, should be sent up to Aboo during October, November, or December; but every opportunity should be taken of returning the men to the plains for this period.

3*rd.*—As a general rule, there should be frequent relays and exchanges of weakly and recovered men. The advantage of the change to Aboo is seldom increased after a residence of six months on the hill, and a stay of two or three months will generally suffice to restore the strength. It cannot, however, be too much kept in mind, that, in the present condition of the barrack accommodation, the full benefit of the Aboo climate cannot be derived by our weakly soldiers. I venture to conclude this report with a few suggestions, which naturally occur to my mind in looking back at the sanitary defects which, during my experience on the hill, I have had ample opportunity to deplore; but I shall only remark on a few points. Gundermuck having been selected as the site for the new buildings, it is unnecessary to say much with respect to eligibility of position. That site is in my opinion an advantageous one. The whole surface of Gundermuck should be thoroughly intersected with drains, at once to carry off the rainfall, and to ensure complete dryness soon after the monsoon. Each barrack building should be raised at least 4 feet above the highest point of the ground it covers, and be built on a dry solid foundation of concrete. The floors should be laid with slabs, or glazed diamond shaped tiles. Each building should be one storied, and be made to contain not more than 40 men. Each man should be allowed a surface area of 100 square feet, and at least 1,000 cubic feet of space. The barrack room should be not less than 18 feet high, and not more

than 30 feet broad. The side walls should be pierced with doors and windows in abundance, to admit light and air. Each window should reach to within a foot of the ceiling. A window to every two beds would be a proper allowance. The system of over-lapping roof ventilation should be adopted. A high and spacious verandah should surround the whole barrack room, and be fitted with both glass and Venetian windows. There should be two open brick fire-places in each barrack, if possible, in the middle of the room, and not in the walls, for warmth, dryness, and complete ventilation: these fire-places are essential at Aboo. There should be a capacious, well-aired, and properly heated reading-room, in which the men could, with comfort, read, write, or otherwise rationally amuse and improve themselves. Such a room is generally provided for the men at large stations; and here, from the nature of the climate, it is particularly wanted for the convalescent soldiers. There should be provided, in the close vicinity of the barracks, a drying-room, fitted with fire-places or stoves, and have bamboo rails or ropes fixed all round to hang the men's clothes and bedding on in the monsoon. I recommend that there should be accommodation of the above description for 200 weakly men, and that the advantages of the climate should be extended to the troops at other stations besides Deesa and Nusseerabad. There should be, within easy walk of the barracks, soldiers' gardens, where the men might work when so inclined, and from which a constant and ample supply of vegetables might be procured. Soldier-gardeners, however, are seldom sufficiently steady and persevering to ensure successful crops, and it would be necessary to entertain a proportion of mallies and bheesties to carry on the work. After a time, the gardens might be made to pay their own expenses; but at first, considering the amount of amusement, as well as the supply of vegetables the soldiers would derive from the gardens, a small expenditure of Canteen-fund money, in payment of the native workmen, would, I think, be justifiable. There should be a substantial brick-built oven in the corner of each cook-house. This would enable the men to have an excellent change in the way of cooking their mutton ration. Very indif-

ferent roasting and baking is done with the make-shift cook-room furniture at present in use. There should be a large and very commodious chunamed bath-house to every 40 men. Chunam baths or tubs should be supplied in ample quantity. Perhaps a large tub to every 10 men would prove to be a sufficient allowance. The removal of sewerage water and other matters, would have to be considered with reference to the position of the ground and buildings, and conducted on sanitary principles. I would suggest that a monthly return for invalids and weakly men, sent up for change to Aboo, should be made out in a different manner from the present one, or be supplementary to it. In this return, the time of arrival, the cause for which sent up, the condition on arrival, the progress of the convalescence, any new attack of disease, any noticeable effect good or bad on the man's health during the month, perhaps his improvement in weight, opinion as to sending back each particular case after a stated period, and an analysis for the month, with averages, &c. might all be succinctly included, and prove a most valuable guide for the future, as well as a record of the past.

Meteorological and Medico-Statistical Table, Mount Aboo Sanitarium, 1st April 1859 *to* 31*st March* 1860.

Season	Month	Temperature. Maximum.	Temperature. Mean.	Temperature. Minimum.	Rain fall. Inches.	Rain fall. No. of Rainy Days.	Average daily strength of Men.	Admissions.	Discharges.	Deaths.	Average No. of Cases completely treated in each Month.	Average daily Sick in Hospital.	Average duration of each case days	Admissions to Strength per cent. per annum.	Mortality Ratios. Per cent. per annum. Deaths to Strength.	Mortality Ratios. Per cent. per annum. Deaths to Average daily Sick.	Mortality Ratios. Per cent. Deaths to Cases treated.	Zymotic Diseases. Per cent. Zymotic Adms. to total Adms.	Zymotic Diseases. Per cent. Zymotic Deaths to total Deaths.
	1859.				In. cts.														
Hot Season.	April	91°	76°	62°	0 11	1	162	14	10	..	18	14	23	103	..	..	..	92·1	..
	May	90	77	65	0 20	1	175	22	20	1	29	16	17	150	6·8	71·8	2·6	77·7	..
	June......	92	80	68	8 31	9	171	20	18	..	27	19	20	147	..	..	..	90·0	..
Wet Season.	July......	87	77	67	24 6	10	160	11	15	..	22	15	20	82	..	..	..	90·9	..
	August....	77	71	65	16 14	9	161	7	9	..	15	13	26	52	..	..	..	71·4	..
	September.	76	70	65	6 36	11	157	30	17	..	30	15	15	229	..	..	..	96·7	..
Drying up Season.	October ..	76	69	63	..	..	157	36	48	1	55	23	12	271	7·6	52·1	1·6	88·8	..
	November.	74	64	54	..	..	152	56	52	1	61	18	8	442	7·8	66·6	1·4	100·0	..
	December..	66	53	41	..	..	148	32	32	1	40	15	11	259	8·1	77·4	2·1	84·4	..
	1860.																		
Cold Season.	January ..	67	49	31	0 55	1	140	19	23	2	29	13	13	162	17·1	184·6	5·9	52·6	..
	February ..	74	58	42	0 14	1	172	14	10	1	17	8	13	97	6·9	150·0	4·3	57·8	..
	March	86	72	58	..	..	171	13	17	..	21	11	16	91	..	..	..	61·5	..

ANNUAL REPORT OF THE EUROPEAN GENERAL HOSPITAL FOR 1859-60.

BY SURGEON MAJOR A. H. LEITH, M.D.

Presented by the Principal Inspector General, Medical Department.

At the date of last report, the addition of four new rooms for delirious patients, and a new ward over the centre of the main building was in progress; but through the excessive tardiness of those engaged in the work, against which remonstrances were unavailing, the latter was not completed until after the S. W. monsoon, and the roof of the Hospital was thus kept open to the rain, to the very great inconvenience and discomfort of all, but especially of the sick, while at the same time the extent of the accommodation continued to be curtailed. At the end of September the new ward was finished; and from that time the military sick were received as before.

There are now, for male patients, four wards of twelve beds each, two of sixteen beds each, and one of twenty; or 100 beds in all: having an average cubic space of 1,300 feet, and area of 75½ feet, which is by far too little, especially in a building situated as this Hospital is, with houses over-topping, and close to it on three sides. Taking into account the female wards and those for delirious and other particular cases, there are now in all 132 beds. There is no separate accommodation for contagious diseases; and I have been obliged to refuse admission on the female side to cases of eruptive fever.

The new upper ward is valuable, not only for the additional accommodation it gives, but as affording a place where chronic cases, progressing unfavorably in the old wards, can have purer air and more light. This ward, by contrast, shows the great disadvantage under which the sick in the other parts of the Hospital have to be treated, a disadvantage which has been

constantly and painfully before me, and which has from time to time been more forcibly manifest, for the unwholesomeness of the Hospital atmosphere renders the inmates very liable to be attacked with epidemic sickness when this is present in the island. I regret to have this year to add to the record of such cases, that nine patients who had been admitted for other diseases were attacked at various times in the wards with cholera, and that of those who were there attacked, no fewer than seven died; and that some of the Hospital servants living in the premises also suffered from the epidemic disease. The drains and privies have been in a very bad state, and have been the subject of very urgent letters; but the most forcible representations have as yet failed to get completed the repairs and improvements which were asked for at the Annual Inspection of April 1859. It seems most desirable that works of such urgency, and which affect the comfort, health, and lives of men, should at once be executed, instead of being dealt with in a slow routine way. It is hoped that these improvements now in progress will, when finished, meet some of the growing evils attendant on the increasing population of the Hospital; but it is only in a new and better building, on a better site, that the sick can be treated in a perfectly satisfactory and advantageous way.

At the close of the preceding year, the military sick were still accommodated in the Artillery Battalion Hospital, Fort George, while in the European General Hospital, where the building operations greatly limited the accommodation, there remained under treatment 79 patients of the 1,929 admissions of the year then ended. Of these remaining, 5 subsequently died, which, added to the 87 fatal cases that had already occurred, gave a mortality of 92 on the admissions for the year 1858-59, or 4·77 per cent. From 1st April 1859 to 31st March 1860, there were only 1,517 admissions, partly owing to the want of accommodation during the first months of the year, and partly to there being for some time comparatively few ships in the harbour. From these admissions there were in all 134 deaths, and 122 still remained in Hospital on 31st March 1860.

The admissions for fever and febrile cachexia were only 181, which is exactly half what they were in the preceding year.

The decrease is in part owing to the completion of the contract works on the neighbouring unhealthy Island of Salsette, connected with the new water supply. One of the fever deaths was of a military pensioner who was brought from the Island of Elephanta, where he had lived in charge of the Caves, and had for two years been suffering from fever and splenic disease, and latterly from bronchitis; before death he had diarrhœa; he was anæmic, and he died exhausted. Besides the usual morbid appearances in chronic bronchitis, there were found a spleen of firm consistence, of a dirty madder colour when cut, with a capsule in part thick and opaque, and of the weight of 19 ounces; the mucous coat of the colon was pale, and so tumid as to cause the intestine, when laid open longitudinally, to roll itself up into the form of a tube, with the peritoneal coat inwards. This patient was an Indo-European; and his European successor in charge of the Caves, a pensioned soldier, was very soon prostrated by fever, and brought to Hospital, corroborating the opinion entertained of the insalubrity of that island.

There were altogether eight deaths from fever; but in only one of the cases was the disease uncomplicated, and that patient, a seaman, was brought in a hopeless state, and died comatose nine hours after admission. The complications were diarrhœa dysentery, hepatic disease, pneumonia, bronchitis, and meningitis. With a more perfect history of some of such cases, the classification would, perhaps, have been different, and the fever would have been considered the less important part of the ailment; but it is too often the case that those who send patients omit to give any information regarding them, so that, unless the patient himself is in a sufficiently intelligent state to give it, the history of his disease remains unknown. Of the fatal cases, two died within nine hours, and one within twenty-four hours after admission. Besides those who in the returns were numbered as fever patients, many were treated as such, as in a large proportion of the visceral inflammations the endemic fever is a concomitant, and early attention is given to eliminate it when present, by the free use of quinine, because, if left unsubdued, it seriously aggravates the local disease. The morbid appearances found in two of the cases, will be mentioned in connection with

the diseases of the liver and of the bowels. Case II. may be mentioned here: the man was said to have been ill five days with fever, and on arriving at the Hospital, he was extremely weak, with a feeble, irregular pulse, chilly extremities, and hurried breathing. Under the use of spirit of nitric ether, alternated with spirit of ammonia, and of sinapisms, warmth was restored; but he soon became delirious, with heat of head, twitching of the extremities and of the muscles of the face; this was followed by coma, and he died 8½ hours after admission. Besides the evidences of chronic disease, there was found after death very great sanguineous congestion of both lungs; all excepting a small part of the upper lobe of each was by the *stasis* of blood rendered blackish, and so dense, as to show scarcely any frothing on the cut surfaces; their weight was 52 ounces. The cardiac half of the stomach was of a deep red, from capillary injection of the sub-mucous tissue, and the mucous coat of that portion only was injected and softened. The co-existence of these conditions of the lungs and stomach was probably due to some morbid state of the pneumogastric nerves, in the influences of which they both participate. A similar state of black sanguineous engorgement is sometimes found after sunstroke, or exposure to great atmospheric heat, and it has been seen in several cases in this hospital within the last three years, in which a febrile state has followed excessive drinking, and has ended in delirium and convulsions or coma. In each of these cases there has been a greatly injected state of the stomach, although this has not always been confined to its cardiac half. As instances of the concurrence of pulmonary and gastric engorgement, the appended cases Nos. I., VII., and XI. may be referred to.

There was but one admission from Small-pox, and it, as well as the three that remained from the previous year, terminated favourably. There was also a solitary case of Measles.

Cholera was unusually severe; fifty-two cases having been admitted, and the twenty-nine deaths from it have shared largely in raising the ratio of the general mortality of the year. The majority of the cases were from the shipping, or from among seaman ashore on leave. From one ship there were received six cases, and from another four; but those who were attacked

in the wards of the Hospital at different times throughout the year, gave nearly a fourth of the deaths. There was examination after death in 21 of the 29 fatal cases, and the results were nearly uniform, showing congestion of the meningeal vessels; generally some serum in the arachnoid; the heart's ventricles contracted and empty, the auricles full; the blood blackish and treacle-like; the liver and kidneys greatly congested; and the mucous lining of the intestines pale, and as if sodden.

The admissions for disease of the Respiratory organs were 75; and of these, 28 were for phthisis pulmonalis; and of all the deaths of this class, 14 were from that disease. The phthisis patients were chiefly seamen; and of the fatal cases, 9 were from that class of men; while 1 was a Preventive officer; 1 a Scripture reader, whose illness began while he was a Pilot; 1 was a Clerk; 1 an Assistant Apothecary; and 1 a Miner employed in the Railway works, and who had been two years in India. In this case (No. IV.) both lungs were of a very dark colour, and from the cut surfaces black carbonaceous matter, which soiled the fingers, could be squeezed. Of the other deaths, 2 were from pneumonia; one of these (Case V.) was admitted when the disease was in a chronic state, and after death there was found grey induration of the lower half of the right lung, with many small purulent cysts and calcification of some of the bronchial branches; both lungs were free from tubercular deposit, it was complicated with chronic dysentery. The other death was in a seaman, who had been under treatment in his ship, and who, when his state was hopeless, was sent, as is not unusual, to die in Hospital; he died two hours after admission. Both lungs were inflamed, the right one was hepatized throughout, and weighed 61 ounces, and all the abdominal viscera were greatly congested, the liver weighing 100 ounces, and the spleen 27 ounces.

The fatal case of Pleuritis was that of a seaman who died four days after admission, and in whose left pleura there were between two and three pints of pus. There were 21 admissions for Bronchitis and 2 deaths in seamen, one of whom died nine and a half hours after admission; there were found dilatation of arch of the aorta and atheromatous deposit.

The admissions for Hepatic disease were 53, and under this head were fifty-one cases of inflammation of the viscus or its results; the other two were of icterus. Among the recovered cases were two in which hepatic abscesses were emptied by the bronchi. In neither of these were there any dysenteric symptoms, and in reviewing the whole of those discharged, there was dysenteric complication in but 4 per cent., but this must have included some cases of mere congestion; while of 9 fatal cases of hepatitis, which had gone on to suppuration, there were five that showed dysenteric symptoms, and four that had none. Of these nine cases, there were two in which there was no examination after death; but in one of them the abscess had begun to discharge by the bronchi. In those examined there were three that had single abscesses, while in the other four the abscesses were multiple, varying from 2 to 15. In two the suppuration was confined to the right; in two to the left; and in one to the Spigelian lobe; while in one there were five in the right and four in the left lobe; and again, in another there were fifteen small abscesses distributed among all these three lobes. In a case in which an abscess of the left lobe had begun to discharge by the bronchi of the right lung, the abscess lay in contiguity with the pericardium, in which it had induced severe inflammation, with copious effusion of agglutinative lymph; part of the walls of the heart was transformed into fat. Among the other points of pathological interest, connected with the liver, that were observed in the various examinations, was a case of angeioitis, affecting part of the branches of the hepatic vein, and causing a partial *blood-stasis* of the liver, indicated by a greatly intensified reddish brown colour, contrasting remarkably with the pale ochrey yellow of the rest of the viscus, from which it was separated by a sharply trenchant line. In part of the dark coloured portion, there were imbedded in the substance, chiefly near its convex surface and thin edge, numerous small oblong particles, one-tenth inch in length, having the colour, shape, and consistence of boiled rice, and which were found to be of albumen accompanied with fat globules. In this state they had but very delicate limiting membranes, but they could be easily turned out from their parenchymatous matrix. Others

were seen in various stages of metamorphosis, until they passed completely into the form of pus, and then they had become larger and often coalesced, and had acquired very distinct and laminated and firm sacs. The *hæmatostasis*, causing the partial deep colour, can be satisfactorily accounted for by the return of blood, through some of the trunks of the hepatic vein being obstructed by fibrinous plugs, such as were seen in some of the large vessels, and the purulent transformation of the albuminous exudation was the probable cause of the angeioitis. There was no mottling, the deep colour was uniform. (Appended Case VII.)

In two instances of remarkable similarity, and affording grounds for the supposition that small hepatic abscesses were in process of absorption, there was on the anterior convex part of the right lobe, imbedded in its substance, but visible on the surface, and without adhesion of the serous surfaces, a cyst, in one case three-fourths by half an inch, and in the other half an inch in diameter. It contained a yellowish homogeneous substance and of cheesy consistence, but somewhat softer at its centre; the surrounding parenchyma showed no indication of recent inflammation. In each the cyst was dense and white (Cases V. and VIII). In a third case, there were five or six such cysts in the liver.

There were two instances of hydatid cysts in the liver. One of the patients who was a seaman and in Hospital on account of epilepsy, was, on 19th July, suddenly seized with severe pain in the right hypochondrium, increased by any movement of the body or by pressure; there were abnormal dulness on percussion, acceleration of pulse, dryness of skin, and yellowness of conjunctivæ. The pain after some time abated, but at midnight of 21st, he had severe rigor, which was followed by pyrexia and violent vomiting, and the pain again increased. He died collapsed on 23rd idem. There was found in the liver a large cyst filled with cysticerci; the gall-bladder was enormously distended with bile. In the other case, there was, at the convex surface of the liver, a cyst 2 inches by 1½ inch, which, on being cut through, was found to contain a curdy substance, and to have a thick semi-transparent and not very tough membrane, forming many convolutions through its interior, as if a capacious sac, after being emptied, had been crumpled up into a small space.

In Case IX. there was a pigmentary deposit of greyish-green in the hypertrophied interlobular connective tissue of a granular liver, giving it a remarkable appearance, the green contrasting with the buff colour of the lobules. The same pigmentation was found in the peritoneum.

The Dysentery admissions were 143, or 9½ per cent. of the whole, and were more numerous than in any preceding year, although the total admissions were, from the causes above-mentioned, much under those of the years 1857-58, and 1858-59. The deaths from this disease were 36; and in 33 there was examination of the body after death; and to these have to be added 14 other cases, in which, although the principal disease causing death was differently classed, dysenteric ulceration was found. In these 47 cases there was hepatic abscess in 4 only. There was perforation of the coats of the colon in five, but in all these the escape of the contents of the bowel into the sac of the peritoneum was prevented by adhesions produced by the peritonitic inflammation.

The morbid appearances have been unusually diversified, and some good opportunities have been found of observing several of the pathological states that produce the symptoms of dysentery. Some of the circular ulcers have been carefully observed, and at least three modes of their formation have been seen: first, there are seen some enlarged solitary glands, causing slight prominences of the mucous membrane, and accompanied with a few minute red vessels; others a little larger show an umbilicated depression, and in the next stage the mucous covering at the depressed point becomes a ragged ulcerated opening which increases in size until the enlarged gland is fully exposed and then falls out, leaving an ulcerated pit which in the onward course of the disease increases in size. (Cases III. and X.)

A second mode is by destructive or suppurative inflammation in the subjacent tissue, the mucous membrane over the spot sloughing and leaving a foul surface exposed, the disease of the areolar tissue undermining the mucous membrane at the margins of the ulcers, giving them sometimes a peculiar appearance of elevated rings. This form has been less frequently met with than the former. (Case XII.)

A third mode which I have traced, is that in which the process begins in the mucous membrane. The surface of the colon shows circular ulcers of various sizes, and mostly with red margins, also red spots of different degrees of intensity. On looking with a hand-lens at one of the fainter of these spots, a beautiful mosaic is seen of rows of light-colored Lieberkuhnian glands relieved by the darker red colour of the injected capillaries appearing between them. In the spots of intenser colour, the more distended capillaries have displaced the Lieberkuhnian glands; and in a more advanced degree of the process, these have disappeared and a small ragged point is visible. This point increases by extension of ulceration, and the sub-mucous areolar tissue is laid bare. In some spots, the destruction is so entirely confined to the mucous membrane, that the denuded tissue forms, when the ulcer is yet small, a prominence in its middle, that, on a cursory view, may be mistaken for an enlarged and denuded gland. I have used the term *Lieberkuhn's glands* to avoid ambiguity,—mucous follicle being by some used as a synonyme of the glands of Peyer.

In the case XIII. appended, Peyer's patches were injected, prominent, and honeycombed, through destruction of the mucous membrane at the points immediately over the individual glands. A similar appearance was found in a child who died of tabes mesenterica: there were several patches with small circular ulcers in the lining of the cæcum and the transverse colon, each cluster formed of 20 or more ulcers, and there was a large cluster at the sigmoid flexure.

A morbid change in the solitary glands, different from that producing dysenteric ulceration, was also observed; the glands were enlarged and of opaque white, prominent on the mucous surface when about the size of a hemp seed; and when of the size of a split pea, the mucous membrane at the summit had given way; and in a still more advanced state, a fungous enlargement had taken place. The series increased in circumference until there was an elevated disk even as large as 1½ inch, with a flat summit of villous look to the naked eye, but, under a lens magnifying about 12 times, it appeared full of alveoli. At the examination these excrescences were whitish. The appearance

was altogether different from that in the cases of cauliflower excrescences, mentioned in a former report. (Cases Nos. I. and VI. are illustrations). In a man (Case XI.) who had been admitted moribund, the cæcum and ascending colon were found greatly distended, and the mucous coat, which at that part had sloughed *in toto*, was suspended as an inner tube, retaining some connection with the outer coats by bands of areolar tissue, the appearance was such as would be produced by great distension of the outer portion of the intestine after the sloughing of the mucous lining had taken place.

In an examination made by Assistant Surgeon Mead in the case of a seaman, aged 27, who had been a month under treatment for dysentery, which had attacked him on his arrival in India, and who, a few days before death, had intercurrent pleuro-pneumonia, the coats of the colon were not thickened, or but slightly so, and on its mucous lining was seen in patches a thin layer firmly adherent which could be torn away in shreds, but which could not be peeled off whole. This exudation was most plentiful in the ascending and transverse portions, and, where not occupied by this layer, the mucous membrane was of a dark grey, and a few minute circular specks of ulceration were seen in it. The small intestines were free from exudation and from ulceration.

The ratio of mortality in dysentery in any hospital will be greatly influenced by the proportion that the old and the recent cases admitted bear to each other, and also by the facilities or otherwise of transferring the sick before the termination of the disease. The proportion of those who are received into this Hospital at the beginning of an attack of dysentery is but small, so that comparatively few opportunities offer of trying to cut short the disease, and it is often made the receptacle of cases progressing unfavourably elsewhere, while, as there is seldom an opportunity of sending chronic cases to a better climate, those that are admitted must generally remain until health is re-established, or, as too often is the case, until death takes place. Very many of the sufferers would be best disposed of by sending them out of the tropics to their native climate, could they, on the homeward voyage, have the advantages of proper diet and

medical care; but sending them to sea, as men in their circumstances would have to go, to share in the ship's rations of salt meat and biscuit, would be worse than keeping them here with all the disadvantages of climate and indifferent hospital accommodation.

I examined the Medical diaries in dysentery cases, for the last two years—that is from 1st April 1858 to 31st March 1860—and I took, without exception, all the cases which were closed at the end of that period, and in which I found noted the time the patient had been ill before admission. The sum was 242, and the deaths 59, which from the omission of those recovered cases in which the duration of the disease on admission was not noted, gives a mortality 1 per cent greater than that found when the actual total admissions are reckoned. When these 242 admissions were arranged in classes, it was seen that, among those that came into Hospital within the first week of dysenteric illness, there was a per-centage of 11 deaths; while the deaths among those who had been ill a week or more were 31 per cent.

Circumstances allowed an opportunity of judging of the value of sanguineous depletion when freely used, and when used more moderately. Of the 82 cases admitted within the first week of illness, 49 were treated during the two years in one set of wards, and 33 during the same time in another set of wards; and the chief, and apparently the only material difference in the treatment, was in the matter of depletion. In the former group of cases, 19 were bled topically by leeches to a mean amount of 25 ounces, the minimum being 7½, and the maximum 49 ounces; and among these 49 cases there was one death, and of the 19 of them that were bled all recovered. Of the group of 33 cases, 10 were bled to a mean amount of 12½ ounces, the minimum being 4½, and the maximum 27 ounces. The mortality was 8; and of the 10 bled 2 died. In considering these results, it has to be borne in mind that it was not the mild cases in which bleeding was used, but the severest, and such as were attended with greater than the average danger to life. Among those admitted after the disease had existed a week, depletion was not generally beneficial; but there were among the recovered cases some instances which showed the good effect of free

bleeding, when the disease had been two weeks or even longer present, although only latterly in a severe degree. The use of depletion after the first week of the disease requires much discrimination.

The admissions for Delirium tremens were but 41, the rule being to apply the term to those cases only in which waking hallucinations have been evinced, or which have reached the second stage of some nosologists. Cases of *delirium e potu* are included, which, according to those who use the term delirium tremens generically, belong to its first species.

In some of the admissions the disease was complicated with other ailments, which required special treatment; but in all uncomplicated cases of the second species, the plan followed was the same as described in my Report for 1857-58; that is, nothing was done, with the exception of using, in some few cases, the cold affusion, secluding the patient in safety from external injury, and caring for his alimentation. Neither wine, nor spirits, nor any alcoholic liquor is included in the scheme of aliment: all such are at once discontinued, whatever may have been the habits of the patient, and benefit only has been found to result; one immediate good obtained is, that the stomach which was irritable and loathed food, can now take and retain it. There were three fatal cases under this head; but one of these, which ended 2nd June, appears to have been so registered by mistake. The patient, who had been drinking to excess, was admitted with febrile symptoms, and had persistent irritability of stomach, and died exhausted after eight days; there having been no delirium until near the close of life, and then so little as nearly to escape observation. Of the other two fatal cases, one was the mate of a ship, aged 32, who had been drinking hard for three months, and who was admitted delirious and tremulous, with febrile heat, and lips coated with sordes, and pulse 130; the scalp rather hot, but the face pale: cold applications to the head were used, and saline diaphoretic draughts were given. Twenty-four hours after admission he was seized with convulsion, and the surface heat became greatly increased, and he died in an hour. The third fatal case was one produced by the combined effects of drinking and exposure to the sun; he was a

ship's steward, aged 29; he had been drinking hard, and had been sleepless for some time, and had been much exposed to the sun. He was admitted at 1 A. M., July 6th; at nine o'clock his skin became hot and dry; he complained of head-ache; his pulse was 98; the diameter of his pupil was one-third that of the clear cornea, as ascertained by scale or *mydriameter*;* still there was no delirium. A mixture containing small quantities of nitrate of potass and tartrate of antimony was given, and cold was applied to the head; yet the febrile heat continued to increase, and suddenly, at 4 P. M., he became furiously delirious; the pupil increased in diameter to three-fourths; and soon after he was seized with convulsions, and he died at 5½ P. M. the same day. On examination after death, the meningeal vessels were full, and serum was found in the arachnoid and the sub-arachnoid spaces; the lungs, which were otherwise healthy, were so much congested as to weigh 46 ounces.

The deaths from Ebrietas were preceded in one instance by paralysis, diarrhœa, and convulsions; in this, examination of the body was not allowed. In another, diarrhœa, paralysis, and coma were the precursors of death; and in the third, the patient was brought in with vomiting and collapse, and died in an hour and a half.

Three of the cases of Apoplexy were admitted in a state of unconsciousness; and in the fourth, the patient had for some years suffered from severe attacks of mesenteric neuralgia, and had just been admitted for a similar seizure. Excepting some granular degeneration of the kidneys, there was nothing remarkable discovered after death in this last case.

Among the Dropsies one patient died under ascites. He was an imbecile epileptic, who had albuminuria, and also valvular heart disease; the body was not examined after death. Another, a Warrant officer of the Commissariat Department, had been admitted for slight anasarca, from which he had recovered, and he remained in hospital still under that head, waiting to be pensioned on account of his inefficiency, owing to mental hebetude. When apparently well, he suddenly vomited his

* This Mydriameter is described in Transactions Medical and Physical Society, Bombay, No. V. New Series, for 1859, p. 98.

breakfast, which he had just taken, was purged slightly once or twice, and was seized with rigor, from which he could not be revived, and he died in a few hours. The chief point of interest that was found was the atrophy of the brain; the cerebrum weighed but 34½ ounces, and the cerebellum 5 ounces, while 10 ounces of serum supplied the deficiency in the cranial cavity. Besides these 10 ounces, a large quantity of serum escaped from the spinal canal when the encephalon was removed, and the position of the body was altered. (Case XIV.)

In the course of the year, the pathological states of the kidneys that were noted, besides waxy and fatty degeneration, and the frequent congestion and inflammation of the right one by extension from the contiguous inflamed liver or colon, there were two of cystic kidney, and one of calculous nephritis. In this last, the kidney was much enlarged; the calculus was impacted at the beginning of the ureter; the Malpighian pyramids were destroyed; and the cortical portion was converted into a dense white substance, considerably thinned, but retaining its form, so that the columnæ Bertini still remained as partial septa in the sac, formed conjointly by the distended pelvis and the chambers from which the tubular structure had perished, and this sac was now filled with pus. (Case XIII.)

There were three deaths attributed to secondary Syphilis; one of them had been long ill with syphilitic cachexy, and sank with sloughing ulcers of the arms and legs; the others also had ulcers on various parts, and in one the fatal termination was hastened by fever, and in the other by diarrhœa; in neither of these two cases was the body examined after death. Many of the cases entered as rheumatism, and in which the periosteum was affected, were probably of syphilitic origin. In the treatment of such cases, I find it of great benefit to combine aconite with iodide of potassium. For some time I used the extract of aconite, but latterly the tincture, which I find more satisfactory, as well as more convenient in form. I have it prepared after Fleming's formula, which makes it nearly twice as strong as that of the pharmacopœia, and I generally find ten minims twice or thrice a day borne without inconvenience. I begin its exhibition with caution, and sometimes I have to lessen the

dose on account of the warning given by tingling and numbness of the mouth and extremities.

In the fatal case of Erysipelas, the disease originated in a sore on the ala nasi; it affected the face and head, and was accompanied with violent delirium. There was a death from *compressio cerebri;* one from fracture of the ribs in an old man; and one from fracture of the clavicle and injury of the spine; in all these three the injuries were received on board ship. A death from injury is entered under peritonitis: it was a case of rupture of the liver, caused by a fall from a window, and death took place three and a half days after the injury.

The death from Abortion was by peritonitis; it was a criminal case, and the woman was admitted moribund, with violent vomiting which continued until death, and which appeared to have been caused by some medicine that acted on the stomach as an irritant poison. The condition of the ovaries under such circumstances being a matter of interest, was in this instance noted, and although their peritoneal coat was inflamed and covered with effused lymph, their parenchyma showed no marked degree of vascular turgor. (Case XV.)

In 105 cases the body was examined after death, and the morbid appearances noted more or less minutely; but of these 15 only have been appended to this Report.

Among the fatal cases in which the relatives refused to allow examination, there was one of aneurism of the thoracic aorta, which seemed to terminate by internal hæmorrhage; a case of albuminuria in a female that ended with diarrhœa and coma; one of stricture of the urethra, in which rupture of the urethra and extravasation of urine had occurred before admission; a case of burning in a child, and one of trismus in an infant five days' old.

[*Annual Return*

Annual Return of Sick of the European General Hospital for the year ending 31*st March* 1860.

Bombay, 1*st April* 1860.

Class.	Diseases.	Remained.	Admitted.	Total.	Discharged.	Died.	Remaining.	Total.
Fevers	Febris Ephemera	..	12	12	12	..	..	12
	,, Intermittens Quotidiana	2	111	113	111	..	2	113
	,, ,, Tertiana	..	13	13	11	..	2	113
	,, ,, Quartana	1	..	1	1	..	..	1
	,, Remittens	1	44	45	36	7	2	45
	Cachexia Febrilis	..	1	1	..	1	..	1
Eruptive Fevers.	Variola	3	1	4	4	..	..	4
	Rubeola	..	1	1	1	..	..	1
Diseases of the Lungs, &c.	Bronchitis Acuta	..	13	13	11	2	..	13
	,, Chronica	1	8	9	6	..	3	9
	Catarrhus	..	15	15	13	..	2	15
	Cynanche Trachealis	..	2	2	2	..	..	2
	Laryngitis Chronica	..	1	1	1	..	..	1
	Pleuritis	..	2	2	1	1	..	2
	Pneumonia	1	6	7	5	2	..	7
	Hæmoptysis	..	1	1	1	..	..	1
	Phthisis Pulmonalis	5	28	33	17	14	2	33
	Asthma	..	5	5	5	..	..	5
	Dyspnœa	..	1	1	1	..	..	1
	Pertusis	..	1	1	1	..	..	1
Diseases of the Liver.	Hepatitis Acuta	1	34	35	29	6	..	35
	,, Chronica	1	12	13	12	1	..	13
	Hepatis Abscessus	1	3	4	2	2	..	4
	,, Hydatides	..	1	1	..	1	..	1
	Cirrhosis	..	1	1	..	1	..	1
	Icterus	..	2	2	1	1	..	2
Diseases of the Stomach & Bowels.	Stomatitis	..	1	1	1	..	..	1
	Cynanche Tonsillaris	..	8	8	8	..	..	8
	Diphtheria	..	1	1	1	..	..	1
	Vomitus	..	1	1	1	..	..	1
	Gastralgia	..	1	1	1	..	..	1
	Gastro-Enteritis	1	..	1	1	..	..	1

Class.	Diseases.	Remained.	Admitted.	Total.	Discharged.	Died.	Remaining.	Total.
Diseases of the Stomach & Bowels.	Hæmatemesis	..	1	1	1	..	..	1
	Dyspepsia	..	18	18	17	..	1	18
	Dysenteria Acuta	2	87	89	65	18	6	89
	,, Chronica	5	56	61	39	18	4	61
	Colitis	..	1	1	1	..	..	1
	Colica	..	21	21	21	..	..	21
	Obstipatio	..	4	4	4	..	..	4
	Vermes	..	3	3	3	..	..	3
	Diarrhœa	2	66	68	61	3	4	68
	Hæmorrhois	1	6	7	7	..	..	7
	Fistula in Ano	1	3	4	4	..	..	4
	Tabes Mesenterica	..	2	2	..	1	1	2
	Hernia	..	6	6	6	..	..	6
	Peritonitis	..	1	1	..	1	..	1
Epidemic....	Cholera Epidemica	..	52	52	20	29	3	52
Diseases of the Brain.	Cephalalgia	1	28	29	29	..	..	29
	Neuralgia	..	3	3	3	..	..	3
	Pleurodynia	..	1	1	1	..	..	1
	Otitis	.	3	3	3	..	..	3
	Convulsio	..	2	2	1	1	..	2
	Epilepsia	1	6	7	6	1	..	7
	Mania	..	5	5	3	1	1	5
	Apoplexia	.	4	4	..	4	..	4
	Paralysis	..	8	8	4	..	4	8
	Hemiplegia	..	1	1	1	..	..	1
	Ictus Solis	..	2	2	1	1	..	2
	Delirium Tremens	4	41	45	41	3	1	45
	Tetanus	..	1	1	..	1	..	1
	Trismus Nascentium	..	1	1	..	1	..	1
Dropsies	Anasarca	..	3	3	1	1	1	3
	Ascites	..	2	2	1	1	..	2
	Hydrocele	..	5	5	5	..	..	5
Rheumatic Affections.	Rheumatismus Acutus	5	61	66	61	..	5	66
	,, Chronicus	2	75	77	70	..	7	77
	Synovitis	..	1	1	1	..	..	1
	Arthritis	..	2	2	2	..	..	2
	Contractura Genuum	1	..	1	1	..	..	1
	Lumbago	..	2	2	2	..	..	2
Venereal Affections and Diseases of the Genital Organs.	Syphilis Primitiva	2	41	43	31	..	12	43
	,, Consecutiva	2	47	49	34	3	12	49
	Bubo	5	26	31	30	..	1	31
	Cirsocele	..	1	1	1	..	..	1
	Orchitis	3	13	16	16	..	..	16

Class.	Diseases.	Remained.	Admitted.	Total.	Discharged.	Died.	Remaining.	Total.
Venereal Affections and Diseases of the Genital Organs.	Phymosis	..	2	2	2	..	..	2
	Paramenia	1	..	1	1	..	..	1
	Menorrhagia	..	1	1	1	..	..	1
	Uteri Morbus	1	6	7	7	..	..	7
	Hysteralgia	..	1	1	1	..	..	1
	Vomitus e Graviditate	..	1	1	1	..	..	1
	Abortio	..	1	1	..	1	..	1
	Mammæ Abscessus	..	1	1	..	..	1	1
	Gonorrhœa	..	31	31	27	..	4	31
Abscesses and Ulcers.	Morbus Coxarius	1	..	1	1	..	..	1
	Abscessus Lumbalis	..	1	1	1	..	..	1
	Phlegmon et Abscessus	3	17	20	16	..	4	20
	Paronychia	..	2	2	1	..	1	2
	Ulcus	4	35	39	38	..	1	39
	Phagedæna	..	1	1	1	..	..	1
	Furunculus	..	7	7	7	..	..	7
	Tumores	..	1	1	1	..	..	1
	Caries	..	1	1	1	..	..	1
	Necrosis	..	1	1	1	..	..	1
Wounds and Injuries.	Luxatio	..	3	3	3	..	..	3
	Subluxatio	..	13	13	11	..	2	13
	Vulnus Incisum	..	5	5	5	..	..	5
	,, Contusum	..	2	2	1	..	1	2
	,, Sclopitorum	..	2	2	2	..	..	2
	,, Laceratum	1	18	19	18	..	1	19
	Contusio	..	44	44	43	..	1	44
	Cerebri Concussio	..	4	4	3	..	1	4
	,, Compressio	..	1	1	..	1	..	1
	Fractura	4	16	20	11	2	7	20
	Ambustio	..	3	3	1	1	1	3
	Venenitus e Zinci Sulphate	..	1	1	1	..	..	1
	Ptyalismus Mercurialis	..	1	1	1	..	..	1
	Ebrietas	..	109	109	97	3	9	109
	Culicum Ictus	..	2	2	2	..	..	2
	Morsus Equi	..	1	1	1	..	..	1
	,, Scolopendri	..	1	1	1	..	..	1
Diseases of the Eyes.	Ophthalmia	3	17	20	18	..	2	20
	Iritis	.	1	1	..	..	1	1
	Nyctalopia	..	1	1	1	..	..	1
	Cataracta	..	1	1	1	..	..	1
Diseases of the Skin.	Erythema	..	2	2	2	..	..	2
	Erysipelas	..	3	3	2	1	..	3
	Urticaria	..	2	2	2	..	..	2
	Porrigo	..	2	2	2	..	..	2

Class.	Diseases.	Remained.	Admitted.	Total.	Discharged.	Died.	Remaining.	Total.
Diseases of the Skin.	Psoriasis	..	1	1	..	..	1	1
	Herpes..	..	3	3	3	..	..	3
	Rupia	1	..	1	1	..	..	1
	Pemphigus	..	3	3	3	..	..	3
	Condylomata	..	5	5	4	..	1	5
	Scabies	..	7	7	7	..	..	7
	Dracunculus	..	9	9	8	..	1	9
Diseases of Vascular System.	Carditis	..	1	1	1	..	..	1
	Cordis Morbus	..	3	3	3	..	..	3
	,, Palpitatio	..	2	2	2	..	..	2
	Aneurisma Aortæ	..	2	2	1	1	..	2
	Varix	..	1	1	1	..	..	1
	Physconia Splenica	1	3	4	4	..	..	4
Diseases of Urinary System.	Hæmaturia	..	1	1	..	..	1	1
	Nephritis	..	2	2	2	..	..	2
	Albuminuria	..	5	5	4	1	..	5
	Strictura Urethræ	1	17	18	15	1	2	18
Diseases of General System.	Scrofula	..	3	3	2	..	1	3
	Scorbutus	2	30	32	31	..	1	32
	Carcinoma	..	1	1	1	..	..	1
	Lepra Articularis	..	1	1	..	..	1	1
	Elephantiasis	..	1	1	1	..	..	1
	Parturitio	1	8	9	9	..	..	9
	Total	79	1517	1596	1335	139	122	1596

[*Cases*

CASE I.—*Fever: Meningitis: Disease of Peyer's glands in the ileum and colon: Congestion of the lungs and stomach.*

W. H., clerk, ætat 25 years; in India 3 months; said to have had fever for three days, and diarrhœa for a week; was admitted on 9th June 1859; surface was hot; pulse 96, and open; tongue furred, dry, and at edge red; pain over the top of the head; bilious vomiting and diarrhœa. On 10th had slight epistaxis and diminution of fever. On morning of 11th, delirium, with hot head; pulse 108; the diameter of the pupil, observed by mydriameter, was four-ninths that of clear cornea. In the evening fever went off and collapse ensued; and on restoration of warmth he had convulsions, and died 11 P.M.

On examination of the body nine hours after death, rigor mortis was present in the lower extremities only—the capillaries of pia mater full; the arachnoid dry, easily torn, with small opaque spots over the upper part of the middle lobes of the cerebrum; slight adhesions between the hemispheres; a very little serum in the left ventricle; the substance of the brain firm; congestion of the lungs greatest on the right side, on which he lay most just before death, no tubercular deposit, the lungs weighed 38 ounces; all the cardiac cavities full of fluid blood. There was no appearance of coagulation of blood found anywhere. The spleen weighed 13 ounces; the liver and kidneys were normal; the lining of the stomach was morbidly injected; the duodenum healthy; the jejunum injected; the *ileum* had the whole of its inner surface thickly studded with prominent whitish bodies, mostly of size varying from that of a hemp seed to that of a small pea, but in many places so large as from 1 to 1½ inch in diameter; the smaller were covered by the unbroken mucous membrane; the larger were devoid of it at their summit, and the largest formed elevated, soft, round or oval disks, with overhanging edges and a villous surface, on which, under a lens, alveoli were visible. The intervening mucous membrane red; the valvulæ conniventes obsolete; the mesenteric glands enlarged; the ileo-cæcal valve was thickened and ulcerated; the whole inner surface of the colon, besides having Peyer's glands in the form of minute opaque spots, with a central punctum, was likewise studded with prominent white bodies, from the size of a millet seed to that of a split pea; these lay under the mucous membrane, which was in no place broken over them. The mucous coat was morbidly red throughout, but was more deeply so at the cæcum and beginning of the ascending colon, and at the left of the arch and the descending portion.

CASE II.—*Fever: Splenization of the lungs: Solution of the stomach: Granular exudation and ulcers of the colon: Granular liver: Fatty kidneys.*

W. E., military pensioner, ætat 42, in India 22 years; was admitted 21st November 1859, having been ill with fever, diarrhœa, and bilious vomiting, since 17th idem. He was extremely weak; had a feeble, small, and very

irregular pulse; hurried breathing; chilly extremities; and his skin was jaundiced. Warmth was restored and his pulse became more open, but it continued irregular. About 2 P. M., he became delirious, with diminution of the diameter of the pupil to one-fifth that of the cornea, and twitching of the arms and face. At 3½ P. M., coma began, and he died at 4½ P. M., 21st November, eight and a half hours after admission.

On examination 15 hours after death, more than 3 ounces of serum were found in the arachnoid and under it. The cerebral ventricles were nearly empty. The lungs, except a little of the upper lobe of each, were blackish and dense from intense congestion; they weighed 52 ounces. The cardiac half of the stomach, when laid open, was seen of dark colour from sanguineous injection, and the mucous coat was softened in that portion only. The duodenum also was red from capillary injection. The walls of the cæcum were thickened, and at the ileo-cæcal valve they were dense and white when divided. The mucous coat of the colon was covered in greater part with granular exudation, and there were several small, irregular ulcers, and a few circular ones about ¼ inch diameter in the ascending portion. The liver when cut was granular and yellow; its right lobe was firmly bound by old adhesion to the diaphragm; its weight was 88 ounces. There was old adhesion of the spleen to the parietal peritoneum. The kidneys were slightly lobulated; their cortical portion was in part fatty; the Malpighian pyramids were defined by a deep red line of injected blood-vessels; they weighed 15 ounces.

CASE III.—*Phthisis pulmonalis: Circular ulcers of the colon, and also sloughing of its mucous lining.*

J. H. B. A., ætat 33, in India 12 years; formerly a pilot; was admitted 7th March 1860, with much dyspnœa, blueness of lips, and cough with sputum deeply coloured with dark blood; he had œdema of the feet. He was too weak to admit of stethescopic examination of the chest. It was learnt that, in the beginning of 1857, he had had cough with some hæmoptysis; in 1858 purulent expectoration and fistula in ano; that the last two months he had been confined to the house, and last fortnight to bed, with cough and bowel complaint; and that the night before admission he had had hæmoptysis to the extent of about a pint. He died 8th March, about 13 hours after admission.

On examination of the body 3 hours after death, there was found as follows:—Firm old adhesions of pleuræ at upper part; extensive ragged excavations at apex of each lung, containing some clotted blood, also smaller cavities or vomicæ; tubercular deposit throughout both lungs, but chiefly in the right; incipient cirrhosis of the liver; small intestines with lining red, but not ulcerated; cæcum with blood-vessels injected, its lining with circular ulcers; ascending colon at its commencement thickened, and its mucous membrane extensively removed or sloughy; in the rest of the ascending

colon there were many enlarged Peyerian solitary glands, and many small ulcerated depressions, as if left by such glands having escaped—a few such circular ulcers were seen in the transverse arch; a part of the descending colon was thickened, and its inner surface denuded or sloughy. The vessels of the rectum were highly injected.

CASE IV.—*Phthisis pulmonalis: Carbonaceous matter in the lungs: Ulcers in the colon.*

J. J.; formerly coal miner; ætat 47; in India 2 years; had for four months suffered from cough, with progressive loss of strength and flesh; at first had pain in the left side of chest, but latterly only a sense of tightness there; two months before admission had dysentery. On admission, 2nd April 1859, was greatly emaciated; the respiratory sound was deficient in all the right side, and what was heard was harsh or tubular. On left side at upper part the respiration was cavernous, and in the rest chiefly tubular; sputum was muco-purulent; diarrhœa was present. He continued to lose strength; latterly the alvine dejections were tinged with blood, and dropsical effusion became manifest. He died 18th August.

On examination 10 hours after death, there were found a large, irregular cavity in the upper part of the left lung, and tubercular consolidation throughout; the left had three lobes as well as the right lung; 22 ounces of serum were in the right pleura; there were grey tubercles in the upper lobe of the right lung; both lungs were of dark colour, and on breaking up their consolidated parts, the fingers were stained with carbonaceous particles. Ascending aorta dilated, and its lining slightly thickened in patches. Parts of the small intestines red, but not ulcerated. The ileo-cæcal valve was ulcerated; and here and there along the colon were small, foul, circular ulcers; there was one small transverse ulcer in the ascending portion. The vessels of the lower end of the colon, and of the rectum were much injected. The whole mucous membrane of the intestines was tumid; the other viscera appeared healthy.

CASE V.—*Pneumonia: Grey induration of lung: Granular exudation in the colon: Cyst in the liver: Splenic capsule indurated.*

J. N.; overseer of labourers; ætat 48; in India 11 years; had, since the beginning of 1858, been at various times under treatment for fever, dysentery, febrile cachexia, and rheumatism. On 16th April 1859, having been six months out of hospital, he returned, suffering from dysentery and from pain in his chest, which latter had begun three weeks before, and was referred to the right infra-clavicular region, and to the upper part of the sternum, where there was periosteal enlargement. No cough was complained of until 7th May, when he suddenly expectorated a large quantity of white pus. There were then detected cavernous and strongly bronchial respiration on the right side. Cough and expectoration continued, and he had hectic and diarrhœa. He died 7th July.

On examination of the body, the lower, and the greater part of the middle lobe of right lung were found in the state of grey induration, and in it numerous small cysts with pus, and the bronchi were calcified; there were no tubercles in either lung. The liver was slightly mottled, and on the convexity of its right lobe there was an ovoid encysted tumour $\frac{3}{4}$-inch by $\frac{1}{2}$-inch, containing a yellowish substance, which in the centre was semifluid. The colon was short, and its walls were thick; the mucous lining of the cæcum and ascending portion was entire, with the exception of a few irregular specks of ulceration in the latter. The inner surface of all the rest of the colon was rough and devoid of mucous covering, and in the descending part there were patches, chiefly transverse, of granular exudation. The spleen, which weighed $11\frac{1}{2}$ ounces, had half of its capsule very much thickened, of milk-white colour, and cartilaginous hardness.

CASE VI.—*Hepatic Abscess: Disease of Peyer's glands.*

J. B., steam-ship engineer I. N.; ætat 29 years; in India four months and a half; admitted 7th July 1859. He stated he had for seven weeks suffered from pain at the epigastrium; for at least a fortnight he had had diarrhœa. On admission his surface was hot and moist, his pulse 96, thrilling; tongue foul, alvine dejections frequent, thin and green, he had great tenderness in the epigastric and right hypochondriac regions, rendering him almost incapable of any movement which involved the action of the abdominal muscles; there was abnormal dulness beyond the edges of the false ribs, and as high as the fifth intercostal space; there were daily exacerbations of pyrexia and delirium, and pervigilium soon became constant. On 11th he had several large bloody motions. He died in the evening of 11th July.

On examination 9 hours after death, the thoracic viscera were found healthy. The convex surface of the liver adhered to parietal peritoneum at two points, where superficial abscesses existed. The whole concave surface was closely adherent to the stomach, duodenum, and colon by thick deposit of lymph. The right lobe contained ten abscesses, the left three, and there was one between these lobes, and one in the Spigelian lobe. The abscesses varied from one to three inches in diameter, and they all, like cysts, had defined walls, but of little thickness, and the pus they contained was yellowish. The colon was thin, and of large calibre. At the ileo-cæcal valve there was fungus-like thickening internally, and in the cæcum and its immediate vicinity there were spots of like appearance, from the size of a pea to one-third inch diameter; and a gradual passage was traced from mere slightly enlarged Peyer's glands to opaque larger ones with umbilical depression; then to those with a ruptured covering; and finally to a discoid fungus-like patch. The rest of the lining of the ascending colon was not much injected; but that of all the transverse and descending portions was of a deep red, but without ulcers. The small intestines presented nothing morbid in appearance.

Case VII.—*Hepatic disease and Pneumonia.*

S. B., schoolmaster; ætat 37 years; in India 17 years; ill from 22nd Oetober with fever and pain between the shoulders and in both sides, and for the first few days at the epigastrium also; was admitted 2nd November 1859 at 11 A. M. The surface was then hot, dry, and sallow; temporal vessels turgid; slight frontal headache; some tremor; did not comprehend or answer questions readily. Pulse 120; not easily compressed; a little eough, sputum tenacious. Crepitus was found over both lungs, and marked dulness over the lower part of the right one. Dyspnœa was great after midnight, and the skin was pungently hot until 6½ A.M. At 7 o'elock collapse began, and he died at 9½ A.M., 3rd November.

In March preeeding he had small-pox severely, and in August bronchitis, after which asthmatic breathing eontinued.

The body was examined six hours after death, and there was found as follows:—In the *arachnoid* 5 ounees of serum; the vessels on the surfaee only of the brain turgid. Sanguineous infiltration of both *lungs*, but most advanced in the lower lobe of the right; no tubereles. Heart's ventricles empty. *Alimentary canal* free from morbid appearances, excepting deep redness from injeeted vessels in half of the *stomach*, and some patches of congestion in the *intestines*. *Spleen* internally pultaceous; weighed 15 ounces. *Liver* weighed 58 ounees; half its substance towards its eoncave side of ochrey yellow, and of loose, eoarse, granular structure, the other half oceupying most of the convexity, of deep red brown, smooth where cut, and vascular. The dimidiation sharply defined. In the dark part only were encysted particles like diminutive particles of soft boiled rice from one-tenth to one-eighth inch long, more numerous in left lobe, and in it most so near its anterior surfaee; their substanee was of albumen, with oil globules; the cysts were more or less defined: some were dense and of several layers, the eontents of many in the left lobe softening into yellowish pus, some coalescing; the cysts containing pus were thickest. Clots and pinkish puriform fluid were found in some of the large hepatic vessels, and the lining of these was reddish. The *gall-bladder* was thickened and small, and the eapsule of Glisson near it was dense.

Case VIII.—*Dysentery: Perforation of the colon: Cyst in the liver.*

P. S., Engineer, I. N., ætat 37; in India 11 years. Admitted 15th July 1859, having, by his own statement, been ill with bowel-complaint for two or three weeks, and having at the same time been drinking freely. Had probably been longer ill. His alvine dejeetions were liquid and bloody; surface warm and moist; pulse 108; tongue foul, and at the edge red. He did not eomplain of pain, but on 20th he had sense of tightness and of numbness in the abdomen, and his pulse rose to between 130 and 140; the abdomen became tympanitic. He died 23rd July.

On examination five hours after death, there were found agglutination by lymph of the omentum to the cæcum and sigmoid flexure of the colon closing perforations; much thickening of the colon; very large transverse ulcers and sloughs in all its divisions. In the lower half of the colon, at portions where the mucous membrane was still entire, there were very apparent severe longitudinal parallel dark lines, which, on close inspection, were seen to be formed by transverse, contiguous, short streaks of irregular length, and of purplish or bluish colour; on raising the soft mucous membrane, the marks were found to be due to dark blood in congested vessels. The liver weighed 101 ounces, was pale and fatty, and imbedded in it, on the convex surface, was a small cyst, scarcely half an inch in diameter, containing a pale yellowish substance, softest in the centre. The *kidneys* were pale. The thoracic viscera were healthy.

CASE IX.—*Dysentery: Granular liver, with green pigmentation of capsule of Glisson and peritoneum.*

J. M., overseer of labourers; ætat 40; in India five years. Admitted 22nd December 1859; said to have been eight days ill with dysentery. He was weak, had much soreness of abdomen, scanty bloody mucous motions, and prolapsus ani; tongue was foul, furred, and dry; there was no hepatic tenderness. This illness was complicated with intermittent fever. He improved at first; and, after some fluctuations, on 1st February the dejections became watery and bloody, of putrid odour, and contained black sloughy flakes. He died 8th February 1860.

On examination of the body fourteen hours after death, the thoracic viscera were found healthy; the peritoneum was of a dull greenish-grey; and on laying open the intestines this colour was seen through the mucous coat, where this was not disorganized. The colon was shortened, and, at cæcum, ascending and sigmoid portions much thickened, and in part denuded of lining. With small exceptions, the rest of the mucous membrane of the colon was in a sloughy state, and partly detached. The rectum was greatly thickened, and was totally denuded of mucous coat. The liver weighed 73 ounces, and where cut into showed a rough surface, with prominent lobules of pale colour, with central intralobular stellate puncta very obvious from the presence of dark blood, and the interlobular cellular tissue, greatly hypertrophied and firm, and of a greenish-grey, causing a very unusual appearance: the colour of this tissue was the same as that of the peritoneum, but it appeared more intense. The fluid that could be pressed from the cut surface was of a pale reddish colour, and not tinged with bile. The *gall-bladder* was half full of yellow bile. The capsule of the *spleen* was in part thickened and of opaque white.

CASE X.—*Dysentery: Circular ulcers in the colon, and granular exudation.*

W. B.; warrant officer, Commissariat Department; ætat 33; in India 17 years; ill 8 months with bowel-complaint; was transferred sick from

Poona 17th November 1859. He was emaciated and exsanguine; his stomach was irritable; alvine evacuations frequent, yeasty in appearance or thin, containing undigested food, and of mixed green and yellow; there was tenderness in the course of the transverse colon and in the right iliac region; pulse 100, weak; tongue clean, and rather dry. Although the dejections became less numerous and less copious, he lost strength. A sense of burning at the stomach and along the œsophagus and hiccup made him refuse wine or other stimulants. He died exhausted 4th December 1859.

On examination three hours after death, the *thoracic* viscera were normal. In abdomen the mucous membrane of the stomach and small intestines was pale and tumid. Ileo-cæcal valve with thick, dense walls; its lining much injected and ulcerated. Cæcum dark from sanguineous injection of capillaries of the muscular coat; the mucous lining of this and of all the colon tumid, and in many places covered with whitish granular exudation, and dotted with numerous bright red papillæ, mostly irregularly scattered, but here and there with slight arrangement in transverse lines, many of which, on close inspection, were seen to be ulcerated. There were also enlarged Peyer's solitary glands; the mucous covering of some of them had ulcerated, and, apparently from the escape of the glands, there were here and there small circular pits (such pits were experimentally produced by squeezing out enlarged glands through ulcerated openings). The mucous coat was easily detached, and below it the tisue was infiltrated, having in cross section a firm, clear, gelatinous appearance. The spleen had a thickened capsule closely adherent to the abdominal wall and to the upper part of left kidney; that kidney was not large, but its cortical substance was far advanced in fatty degeneration. The right kidney was abnormally long and had two pelves; there was a red congested line, separating the cortical from the tubular portion, in section, but no degeneration of substance was observed.

CASE XI.—*Dysentery, with extensive sloughing in the Colon.*

H. J., seaman; ætat 30; in India two months, admitted 29th November 1859; said to have been ill with bowel-complaint ten days, and from the 25th idem to have had vomiting; and from 28th hiccup. On admission he was very weak, with pulse 120 to 140, and thready; extremities and forehead cold and damp, voice feeble, tongue furred and dry, thirst great; but his stomach rejected all ingesta, mixed with bile. There was a tender tumefaction between the anterior spine of right os ilium and the umbilicus. After admission he had but two alvine evacuations; the last was thin and offensive; the urine was dark and alkaline. He died 30th November.

On examination 14 hours after death, the morbid appearances were as follows:—The lungs somewhat congested, weighing 29 ounces; general redness of the peritoneum; a slight agglutination of the convolutions of the small intestines and the omentum by effused lymph; the vessels of the mucous lining of the pyloric half of the stomach were greatly injected; the lining of ileum was of a leaden hue; the cæcum and ascending colon were

closely adherent to the abdominal wall; the colon there had been largely perforated; part of the cæcum was thick, dense, and of cartilage-like firmness, as if from former disease; the mucous lining of the cæcum and ascending colon had sloughed in its whole extent, and formed a dirty yellowish-white tube, mostly detached, but still having bands of areolar tissue supporting it in the interior of a much larger tube formed by the other coats, which seemed to have been greatly increased in caliber by distension after the sloughing had taken place; in the transverse colon there were several sloughs of various sizes, and somewhat transverse in direction, under one of these perforations was just completed; the mucous lining of the descending colon was of leaden colour, and was free from ulceration; the liver had slight recent adhesions to the intestines, but its structure was healthy; the right kidney was larger than the left, and in section showed an outline of deep congestion round the Malpighian pyramids; the spleen weighed 14 ounces.

Case XII.—*Dysentery: Sloughing of Cæcum, and circular ulcers in the colon: Hepatic abscesses.*

J. G., employed in a cotton factory; ætat 26; in India 5 years; said to have been ill and under treatment for a month with dysentery, and the last two days to have had swelling and tenderness of the abdomen, and inability to micturate, the pain being most in the right iliac region; was admitted 30th December 1859; the abdomen was then tympanitic, surface of moderate warmth; pulse 120; stomach very irritable, the bladder requiring to be relieved by catheter; the bowels acting involuntarily; the evacuations being at first copious and of grey colour, and afterwards scanty and bloody. On 31st he became collapsed, and he died 1st January 1860; 45 hours after admission.

On examination 3 hours after death, there were found signs of general peritonitis; the inflammation most intense—as measured by quantity of lymph—in the pelvis and iliac fossæ. Besides recent agglutinations, there were old firm bands, like areolar tissue, binding the jejunum, and part of the ileum to the vertebræ; the mesenteric glands were enlarged,—the mucous as well as other coats of the small intestines had inflammatory injection where in contact with the perforations of the colon, and the lower end of the ileum also was similarly injected; but in no place was there ulceration. The cæcum and ascending colon had been perforated; the former was in great part a black sphacelous pulp; the latter was increased in caliber, its walls thickened, and containing purulent deposits or small abscesses. The transverse colon inflated to a caliber of 4½ inches, the descending colon also had been perforated. The whole of the colon had its mucous lining studded with circular ulcers or spots, with black sloughy surfaces, and edges like prominent rings that were found to be undermined and puffed up; these spots were mostly ¼ to ½ inch diameter; but some were ¾ inch or more. All the convex surface of the *liver* closely adherent to the diaphragm. In the right lobe, parallel to, and near its edge, an elongated abscess, with 1½ ounce

curdled matter; the limiting membrane thin; the parenchyma beyond deep red. The lobulus Spigelii almost entirely occupied by an abscess containing thick, homogeneous, pale, greenish-yellow pus; this abscess also had very thin adventitious lining.

Case XIII.—*Calculous Nephritis: Dysentery with disease of Peyer's agminated glands.*

F. C., of Preventive Service; ætat 23; born in India; said to have been treated for cystitis, following gonorrhœa, in 1855, from which time his history is wanting, except that in 1858 he had fever with hepatic and splenic enlargement. In the beginning of April 1859 he was seized with great pain and tumefaction, that gradually increased until in three weeks, it reached from the left hypochondriac and lumbar regions to the umbilicus. The pain and swelling then subsided; but his weakness was increased by continued bowel complaint, until he was admitted into hospital, 5th August, in a state of great emaciation; his pulse feeble and frequent; tongue dry; alvine evacuations thin, or of bloody mucous with tenesmus; abdomen retracted, and fulness and dulness at its left side. He died 9th August 1859.

On examination 14 hours after death, the left kidney was found enlarged; its cellular coat, and also its proper capsule, greatly thickened, dense, and hard; it contained 5 ounces of thick yellowish pus in a multilocular cavity, the loculi being in place of the perished Malpighian pyramids, and communicating freely with the pelvis and the dissepiments being the columnæ Bertini converted, as was the rest of the cortical substance, into a hard, white, opalescent, cartilage-like substance; a calculus was impacted in the beginning of the ureter. The capsule of the spleen was thickened and adherent to the peritoneal covering of the kidney. The cæcum, the beginning of the ascending colon, and the rectum, had the mucous membrane of a deep red colour, but without ulceration. In the upper part of the ascending, and the first half of the transverse colon, many of Peyer's glands were enlarged, opaque, and prominent; in the rest of the transverse, and in the descending portion, the mucous lining, besides being morbidly injected, had Peyer's patches red and slightly elevated, and honey-combed with small, circular ulcers, many of which had in their area the spherical enlarged glands, from which the mucous covering had perished; this latter portion of the colon was contracted in caliber.

Case XIV.—*Atrophy of the Brain.*

W. McG., Commissariat Warrant Officer; ætat 40 years; in India 20 years; was admitted 24th September 1859, on his arrival from Ahmedabad, where, for two years, he had suffered from "disordered state of the liver, stomach, and bowels," owing to intemperance. On admission he had œdema of the legs, but by 8th October it had quite left him; but he continued to complain of weakness, of pain in his limbs, and of increasing deafness, and

he was apathetic and wanting in intelligence; he however took his food, and increased in flesh, and looked well. While still in hospital, waiting to be pensioned, in the morning of 17th November he retched a little, but he took his breakfast as usual; his bowels acted a second time before 10 A. M., and he was at that time seized with rigor like that of ague; there was no reaction, and he died 1 P. M. There was no unconsciousness, except during the last few minutes of his life.

On examination 3½ hours after death, there were found, on opening the arachnoid, 10 ounces of serum, and subsequently, on raising the cerebellum, much flowed from the spinal column; the right lateral ventricle was empty, and the left contained very little; the vessels on the surface only of the brain were full; the cerebrum weighed but 34½ ounces; the cerebellum 5 ounces, and it was firmer than the cerebrum. The lungs collapsed when the thorax was opened; they weighed but 20 ounces. The heart's cavities were full; its walls were hypertrophied, and when emptied it weighed 14½ ounces. There was very little serum in the pericardium; none in the pleuræ. The abdominal viscera were greatly congested, but blood flowed quickly from the divided vessels, being unusually fluid, and the congested appearance soon disappeared. The liver was granular, and its connective tissue was hard; the gall-bladder was full. There was no serum in the peritoneum. No other morbid appearances were found.

Case XV.—*Abortion: Peritonitis.*

L. B., ætat 40; in India 11 years; was admitted about noon, 3rd February 1860. She was extremely weak; the extremities were cold and clammy, breathing hurried, lips red and parched, tongue furred, brown, and dry; pulse 120, small, and weak. She had frequent vomiting of brownish fluid with blackish or greenish flocculi; the abdomen was distended, and at the hypogastrium tender. Collapse progressed, the vomiting continuing until she died at 8 P. M. of the same day. Before death, she said she had, by aid of a Native woman, procured abortion; that medicine by mouth and by vagina, and mechanical means having been used, twin fœtus were expelled on 31st January.

Eighteen hours after death putrefaction was rapidly advancing. Peritonitis was general, but most intense in the pelvis. When the thick covering of exuded lymph was removed, the peritoneal coat of the uterus was reddish; the Fallopian tubes were of dark purple colour; the peritoneal covering of the ovaries was red, but there was no vascular engorgement seen in their substance when laid open. In the right ovary there were two corpora lutea of equal size, containing gelatinous fluid, and with a yellow outer tunic. In the left ovary a smaller and harder spherical cyst was found. The inner guage of the uterus from ostincæ to fundus was 6 inches; the muscular wall of the uterus (seven-sixteenths of an inch thick) apparently not diseased. The inner surface was red; the lining membrane, which was flocculent under

water, could be readily raised from the subjacent tissue, and was firm, except close to the inner end of the cervical canal, where it formed a sloughy ring, sharply defined towards that canal. There was the appearance of foul denuded cellular tissue at the vaginal end of the cervix. The placental attachment had been at the fundus, as indicated by a rough surface with hard, dark red projections, and with a sinuosity partially dividing it. No wound was detected. The stomach at its cardiac end was internally red and soft, with small ulcers sharply defined. There was no lesion in the rest of the alimentary canal, nor in other organs. The stomach was submitted to examination by the Chemical Examiner, but no poison was detected.

REMARKS ON THE RATIONAL TREATMENT OF CHOLERA.

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To read but one quarter of the multitudinous essays on, or histories of attacks of Cholera, it might be well supposed that the subject was exhausted, or nearly so; but, if such papers are compared rigidly, it will be found that they agree more completely in the 'average proportion of mortality' than in any other respect. Many physicians extol the success which has attended such-and-such a method of treatment, but do not even furnish the data on which their opinions are founded. Statistics as to the mortality of any epidemic disease always require to be received with caution, as the different circumstances under which epidemics occur have the most marked effects on the results, when these are placed in a tabulated form; still more do the statistics of any particular method of treatment require to be subjected to the most severe scrutiny, before the medical enquirer can satisfy himself that to such treatment is the more favorable result to be attributed. To judge of the superiority of one plan of treatment over another, a series of cases fully reported require to be placed side by side, each symptom to be recorded, as well as all the external circumstances in which patients are placed, and above all the examiner must satisfy himself that the different observers record their cases in the same way. No one will doubt that much laxity of method exists in the medical literature of the present day. Many of us have preconceived ideas; and it is most difficult for any one who has a medical hypothesis of his own on any subject, to state his facts candidly. He endeavours to be candid, but insensibly (as a general rule)

that part, or those portions which seem to support his own views receive undue prominence. As an exemplification of what has been said, I would instance the late discussions on the question of blood-letting in internal inflammations. In this controversy, it was attempted to prove the superiority of certain plans of treatment from the experience of many hospitals and physicians; but it must be evident that it is only fair to compare cases of equal severity, occurring under much the same circumstances, and in patients of equal resistance, or in other words, of equal powers of system. Epidemics vary from year to year in intensity; as much as do the attacks of pneumonia in different patients in the same season. Hence to compare the results of treatment in cases varying in severity, circumstances, idiosyncrasies, &c. is but to argue on grounds which are to us quite uncertain and unfit for comparison.

The different degrees of severity, with which malaria of the same kind affects different individuals under apparently the same circumstances, afford another example; as also the very different degrees of fever caused by malaria in its most aggravated form as in the Soonderbunds, and the usual mild attack of intermittents in many of the Provinces. In the Soonderbunds, Terai, and other jungles similarly circumstanced for the production of malaria, a short exposure is sufficient to procure, almost with certainty, a most severe and dangerous attack; but exposure to the now comparatively mild malaria of the Lincolnshire Fens is not always followed immediately or even for many months in the affected reaper, or until in fact the patient is debilitated and exposed to some exciting cause of disease, when the hitherto latent poison becomes developed, and he has a distinct attack of ague if nothing more. These are examples of the same disease generated by the same poison, but that poison is of different degrees of intensity. Who could think it right to compare the treatment and results of these two cases of disease as determining the efficacy of different methods of treatment? So it is with Cholera, there are cases and epidemics varying so much in degree that the results of treatment cannot be numerically compared as determining the value of remedies.

It is impossible to read many of the papers on Cholera that from time to time appear, without being forcibly convinced that most different ideas prevail as to its pathology and the general indications to be kept in view in its treatment. In a report, presented to the Epidemiological Society by Dr. Babington, of the Cholera, which affected the Black Sea Fleet in 1854, various methods of treatment are detailed, but only the treatment *en masse* in each ship. The number of persons attacked was 711, and it is stated that 134 of these were without premonitory symptoms; but of these 134 cases 114 were in the "Britannia," and the answer from the Surgeon in respect to the number unaffected by preliminary symptoms was as follows, "not able to state with accuracy, but would give as my opinion that one half at least had no preliminary symptoms whatever." Dr. Babington's condensed report on the outbreak in this ship I quote, as it shows in all probability why the disease was so virulent on board. "In the *Britannia* there were attacked 229, of whom died 139. The crew were in a high state of health when the disease broke out, so that Mr. Rees cannot assign any exciting or predisposing cause for its advent. The great outbreak, however, he thinks, was probably caused in a great degree by the closing of the deck ports on the previous night, on account of the boisterous state of the weather. The treatment was various: sulphuric acid; calomel and opium in large doses; calomel, lead, and opium; chloroform; creosote; various stimulants internal and external, &c. All means signally failed during the advance and at the climax of the disease, but during its decline medicines acted beneficially; and then a combination of lead, opium, and calomel was of most use. The prophylaxis recommended is keeping the men in a high state of health, and putting to sea in favourable weather. This measure proved useful in the majority of cases, and its want of success in the *Britannia*, was owing to the misfortune of being obliged, from the weather, to close the ports when the disease was at its height."* It may surely be said that the closure of the ports caused the disease to be specially virulent, and the concentration

* Transactions of the Epidemiological Society, 1856.

of the poison was probably more than anything else the reason why so many men were attacked without premonitory symptoms.

The *Apollo* troop-ship received 89 of these men of whom 26 died.*

The whole of the report quoted above, though valuable, does not at all determine the cause of the disease, but it shows how, in many cases and circumstances, it may be aggravated. In the *Trafalgar* the most efficacious treatment was said to be Tartar emetic and Epsom salts in small doses, but there are not data sufficiently exact to enable a decision to be formed as to the real value of the remedies. In the *Albion* scruple doses of calomel with one grain and a half of opium were given at first, and ten grains of calomel every hour, until the alvine evacuations assumed a fæcal character. The mortality was 70 per cent of the attacked! Stimulants and other treatment were used without the least benefit.

The matter embodied in the paper read by Dr. Babington was condensed from a series of questions presented to all the medical officers of the Fleet. There are no details of cases nor anything beyond general treatment, but the medicines employed were much varied, from tartar emetic and Epsom salts to opium and stimulants. The prophylaxis agrees in almost every case, and may be said to be to keep both body and mind in as high a state of health as possible. They "admit of division into those which respect the ship and those which respect the men. As to the former, the chief recommendations are cleanliness, ventilation, fumigation, whitewashing, dryness, the free use of chloride of zinc, and, as the most important of all, a shifting of locality."

"The preventive measures recommended, as applicable to the men, are as follows: a generous diet with fresh provisions when procurable; recreation; amusement; comfort; warm clothing; the use of flannel in general, and especially a belt round the abdomen; the use of quinine wine; a strict surveillance and immediate attention to diarrhœa however slight; the serving out of tea or coffee before going on deck in the morning; a

* The Cholera at Bhurtpore in 1856 affords, as I shall hereafter show, a cholera epidemic so severe as to be not only without premonitory symptoms, but in the majority of cases at first without purging during the disease.

sufficient supply of clean bedding, well aired; the prevention of intercourse with any ship or locality where cholera exists; abstinence from unripe fruits; from excesses of all kinds; from exposure to night air, wet, and a hot sun; or to the early morning air without food; the avoidance of fatigue, especially in the sun, and of exposure to sudden chills, or long fasting."*

It would have been interesting as a collection, if the Medical Officers who treated this Black Sea Fleet epidemic had recorded their individual reasons for the treatment adopted. If a judgment may be formed from the great variety of treatment, their views of pathology must have been widely diverse.

I think that the effects of the poison of cholera may be advantageously studied in its four stages.

1*st Stage*, that characterized by diarrhœa and not unfrequently accompanied by general malaise and dyspeptic symptoms.

2*nd Stage*, that of development into true cholera, or urgent diarrhœa and vomiting of the well known rice-water fluid, accompanied with spasm of some of the voluntary and involuntary muscles.

3*rd Stage*, that of collapse where the vital powers are all depressed in the most marked degree, during which death takes place, or the next stage sets in.

4*th Stage*, that of reaction. This is rather, I think, the state in which the poison has left the system, and the changes that take place in the economy are usually so like each other, though modified generally by the idiosyncrasy of each patient, that it requires to be considered separately.

1*st Stage*, or the diarrhœa that prevails so extensively at the time of a choleraic invasion or epidemic. (The other symptoms are not of the same value, and I shall not further allude to them.) This diarrhœa may not be present in many instances, in which the disease seems to break out at once into its full and fatal development. It always accompanies Cholera in European countries; and in the Black Sea Fleet usually lasted for a variable number of days. Diarrhœa itself was prevalent almost throughout the Fleet. The diarrhœa accompanying an epidemic

* As before cited.

of cholera has no special characteristics. Almost every writer of authority is disposed to regard it as partaking largely of the cholera disease. I believe that it is a true but mild form of cholera, and is quite as much referable to the effect of the poison that produces cholera, as is that disease itself. Impartial consideration of all the circumstances seems distinctly to point out that, although Cholera in Eastern countries very frequently occurs without this premonitory or rather primary development, yet I believe its action in such cases, nay in almost every case, may be compared with that of other poisons. Many poisons when taken in very large doses prove fatal with symptoms very widely differing from those which occur when the poison is taken in moderate, or in small but long continued doses. As an example of this, arsenic is most remarkable; and undoubted cases of poisoning by this mineral present as great or greater varieties of symptoms than do cases of cholera and so-called choleraic diarrhœa.

It is almost impossible to give in the earlier stages of this diarrhœa any absolutely diagnostic mark, but there is one particular symptom in choleraic which I have not seen in ordinary diarrhœa, or in the purging produced by the more common purgations. It is the force with which the fluid motions are ejected from the rectum. This symptom may not unfrequently assist us in forming a diagnosis as it is often early developed.

In this stage there is nothing in the appearance of the matter passed by stool to distinguish between it and ordinary diarrhœa, but its importance is very great, for it is at this time that *Cholera is a specially curable disease.* It is true, that it not infrequently cures itself, or at least that cases of diarrhœa occurring during cholera epidemics recover without treatment. It may be argued from this recovery, that it was not choleraic, but simple diarrhœa resulting from some slight derangement of the digestive organs. This view, tenable it may be from our not having positive proof to the contrary, is not probable when it is remembered that the tendency of every disease is towards cure, and that nearly as many fairly established cases of cholera are cured by expectant treatment, as there are by the aid of medicine, so it may be

fairly stated by the analogy just cited, that it being self-curable in many instances is no argument that the diarrhœa now under consideration is not choleraic. Dr. Morehead says:* "The prevalence of diarrhœa in seasons of epidemic cholera obtains in India as well as in European countries; but I believe that this event is more common in the latter than in the former. The relation, however, which these two affections bear to each other is the same in both countries. The diarrhœa, if neglected, is very apt to pass into cholera; and, on the other hand, it is amenable to treatment in a large proportion of cases. We may express these facts in other words, by saying cholera is not unfrequently preceded by a premonitory, and often readily curable diarrhœa." I think we may even go further, and say that cholera frequently in its first stage manifests itself like a simple diarrhœa. Sir J. R. Martin says:† "The diarrhœa which prevails when cholera is epidemic, is due to the same cause as cholera itself." Dr. Arnott, in his account of the Kurrachee epidemic in 1846, distinctly recognised these early symptoms, and as promptly took the only method of remedying the disease,—early treatment.

Dr. Edward Charlton, in an admirable review on the Norwegian Statistics of Cholera,‡ says, on the point of preliminary diarrhœa: "We regard that diarrhœa as a part of the disease itself,—as the direct effect of the cholera poison; and we find, both in this volume and elsewhere, many instances tending to prove that persons labouring under this diarrhœa alone, and without any other symptom of cholera, may convey to other persons true cholera, which may develope itself in these individuals in the most virulent form."

I may here relate what was told me by Dr. Mathias, of Ulwar, in reference to an uncommon white diarrhœa, which was prevalent in many of the villages around Kerowlee and Agra during the early part of 1856—immediately before the very fatal epidemic of cholera of that year broke out in the neighbourhood. He says there was an uncommon white diarrhœa in many villages in the districts named, which attacked great numbers of the villagers;

* Researches on Disease in India, 1856, Vol. I., p. 403.

† On the influence of Tropical Climates, 1856, p. 334.

‡ Brit. and For. Med. Ch. Review, No XXXV., July 1856, p. 113.

was generally intractable for some days, running its course in about a week. No death, as far as Dr. M. heard, took place from it. But in the villages where this diarrhœa had prevailed, no cases of cholera occurred, though it was all round. These jottings are, I think, only suggestive of more careful examination for the future in districts where cholera has been, or is prevalent ; and we should endeavour in this country to trace, at the time, the peculiarities of the places where cholerais more than usually prevalent, and also of those exempted when cholera is prevailing all around.

2nd Stage.—The development into what is true cholera. After the first stage has continued some uncertain time, or often simultaneously with its approach, the simple diarrhœa merges into the purging of whitish rice-water fluid ; vomiting of colorless fluid, with shreds of mucous, and cramps supervene. This state is that which, up to the present time, has commonly been regarded as cholera. I have already endeavoured to show that the affection, which has hitherto been called choleraic diarrhœa, is in reality a mild form of true cholera.

In the early part of this stage, the pulse is not very much affected, but with the constantly recurring discharges, it speedily becomes much quicker and weaker ; and towards the end of the stage, coldness of breath distinctly supervenes ; the cold sweat and surface become sensible to our touch, and cramps, which generally first attack the abdomen, extend to the lower, and less frequently to the upper extremities. The blood at this stage is considerably affected. I quote the results of Dr. Robertson's analysis.*

	I. Early Stage Rice-water Purging.	II. Incipient Collapse.	III. Collapse.	IV. Reaction.
Fibrine	2·70	3·2	3·2	3·7
Serous Solids { Organic	82·2	93·4	102·4	78·2
Serous Solids { Inorganic	7·8	6·9	6·9	6·6
Globules	103·4	129·9	129·9	122·6
Water	803·9	766·6	757·6	788·9
Sp. Gravity	1053·1	1059·5	1066·3	1055·8

* Edinburgh Monthly Journal, Sess. 1853.

Dr. Robertson reports that at first the globules are about 24 per mille diminished, the organic solids of the serum increased by 10 in a thousand, and the mineral constituents "considerably above Rodia and Bequerel's average, and a trifle below Andral and Gavarrets." Again we find that, in this stage, the "blood was usually obtained with facility; was of natural color;" and "after standing for a few hours, formed a large, easily lacerable clot, from which the serum easily separated." It is evident that, up to the present stage, the blood has been comparatively little affected, but afterwards the analyses prove how much thicker it has become, and how unfitted to perform its function. It circulates with difficulty; and the coldness of the surface, and the cold sweat, are both to be referred to the want of circulation of properly aërated blood. Whether the cramps are also due to the direct influence of the cholera poison on the nervous centres or peripheries, or to the non-supply of duly oxygenized blood to the parts in which the cramps are present, must be an open question; still it is one on which we may bring our present knowledge to bear to a certain extent. Usually the cramps are first present in the digestive canal. This is only what might be expected, as it is so unequivocally the digestive system that first manifests the derangement to the greatest extent. As the disease progresses, the cramps in the abdominal connections cease in great measure, and are replaced by cramps in the parts most distant from the centre of the circulation. The early supervention of cramps in the digestive canal does not at all disprove the idea that it is to the change in the blood that the cramps are due, for this change is first of all markedly present in the digestive canal. The affection of the blood in this region is further evidenced by the stoppage of secretion of all the organs. The cessation of the secretion of bile occurs about the same time that the disease has passed from the first to the second stage. The secretion of the liver being separated from blood which has, in its passage through the vessels of the digestive canal, been specially amenable to the results of the phenomena of cholera, or blood which has supplied the serous dejecta, and the large amount of epithelial cells whose débris are so abundant. Hence there is no difficulty in account-

ing for the early period at which the liver ceases to perform its function. There is ample proof, in the researches of late physiologists, that the liver is not merely an eliminative organ of matters already existing in the blood, as is the kidney, but that it has the power not only of pouring out its secretion into the hepatic ducts, but also it materially modifies the composition of the venous blood circulating through its substance. As yet there are no experiments on the livers of patients who have died of cholera, which determine whether this modifying power is still retained, but, judging from the action of other organs, I should think that the secretion of bile and the modifying power of the cells of the liver are both in abeyance at the same time. Again, if it is supposed that the chief products of the secreting organs are formed in the general changes which have taken place in the blood itself, most probably in the capillary system, still less difficulty is there in attributing to the changed condition of the blood the non-elimination of certain matters.

The secretion of urine is stopped at an early period of this stage; and should any fluid be discharged by the urethra, it will be found in the majority of cases not urine but a fluid containing few of the normal products of the kidney, and generally a considerable proportion of albumen.

I have already quoted in a tabular form the changes in the proportion of its constituents in the blood itself, but microscopic researches, and still more the symptoms which accompany this stage, plainly show that other changes, either consecutive on or consentaneous with these changes in the chemical constitution are present. The cold breath, the blueness on the surface, more especially at the extremities, and the hurried respiration followed by asphyxia, all point to the non-aëration of the blood, and assuredly indicate through what channel danger threatens. The asphyxia threatened is not of the ordinary kind, viz. by the prevention of access of air to the lungs, either by mechanical means, as in forcible compression of the larynx or trachea, or from the results of various diseases including different parts, but it appears to be caused by the inability of the blood to receive oxygen and give off its usual amount of carbonic acid. The microscope also shows the blood corpuscules shrivelled up,

often broken and much changed in form. With regard to the widely accepted doctrine, that the first effect of the cholera poison is on the sympathetic nervous centres, I have never seen any arguments stated, nor witnessed any facts, which seem to me to prove any connection between these nerves and the effect of the cholera poison. I believe, as yet, we are only warranted in stating that such and such changes have taken place in the blood, and that to attribute these changes to the sympathetic system is only to obscure our views of the real facts, by giving prominence to what is not ascertained but only rests as an hypothesis, and an hypothesis that has not been capable of demonstration. To give prominence to such hypothesis is to retrograde, and to prevent the earliest induction of truth.

The length of this second stage varies greatly, it may continue only an hour or two, or it may extend to as many days, or even more. Either the discharges become lessened in quantity and ultimately stop, the pulse regains its power, or else the third stage (collapse) sets in.

3rd Stage.—The account of this stage need not be extended, after what has been said of the pathology of the second. It is the full development of the disease, well expressed by the term "collapse." Sometimes it is slight, and speedily passes off; at other times it supervenes almost consentaneously with the advent of the disease, and in this latter case it is rarely recovered from. The restoration of the pulse, and some degree of warmth to the surface, usher in the fourth stage or reaction.

4th Stage.—This may be short, and apparently differing little from ordinary restoration to health, and such will usually be the case when the primary disease has not been intense or long continued, and more especially when the secretion of urine has returned speedily. In other cases fever, resulting apparently from a poisoned condition of the blood, supervenes, and runs a course, more or less severe, depending upon the state of system of the patient and the intensity of the previous disease. There can be little doubt that during the preceding stages of cholera, the wonted changes have not been taking place among the particles of the blood, and the nonsecretion of the various glands may be looked upon, not altogether as an

evidence that they have lost their secreting power, but that the materials are not present in the blood to excite them to secretion; the kidney, for example, secretes a fluid containing albumen, &c. long before it is able to take up its normal function. Its restoration to full function does not take place for some days. In the Medico-Chirurgical Review for April 1857, in a notice of Lebert's treatise entitled "The Cholera in Switzerland," the following record of experiments fully proves what has been stated: "The further examination of the urine by Messrs. Lehmann and Volk of Zurich, showed the chloride of sodium and the urea to be considerably diminished during the first days after the suppression of the urine; that the amount afterwards becomes increased beyond the average, as is the case with the total quantity of the urine, before it returned to the normal medium. Thus we find in one of the cases, that the quantity of urine (24 hours) fluctuated from the third to the sixth day, between 405 and 470 cubic centimètres; that it rose on the seventh to 2879 cubic centimètres, and averaged on the following days nearly 1500 cubic centimètres. Specific gravity between 1006 and 1014. Chloride of sodium from the third to the sixth day, between 0·3272 and 0·9494 gramme; on the seventh day, 7·7215 grammes; on the eighth, 5·5398 grammes. Urea from third to sixth day, 6·266 to 7·094 grammes; on the seventh, 60·594 grammes; on the eighth, 40 grammes. These figures are the more valuable as they agree with those obtained by Professor Buhl of Munich."

Occasionally, the course of a more than usually severe epidemic differs very considerably from the foregoing short account of cholera as it is usually observed. That which visited Bhurtpore in 1856 is a remarkable instance of this difference. Bhurtpore is surrounded on two sides by a jungly swamp for eight months of the year, its position is very low, the streets are confined and dirty, and owing to its mud walls and constantly recurring bastions, little ventilation can take place. Its inhabitants suffer constantly from intermittent fever frequently recurring, and enlarged spleen is very common. In May 1856 and the following months, cholera of a severe type visited Agra, and some preparations were made for it at

Bhurtpore, by cleansing the fouler parts of the streets, &c.; but a severe epidemic broke out, and lasted some months. The peculiarity being, that, in the earlier cases, and through the severity of the epidemic, purging was not present in the majority of cases. Dr. Bholanath Dass, Sub-Assistant Surgeon in charge of the Bhurtpore Dispensary, thus wrote in his Quarterly Report to Dr. Ebden:—"The symptoms with which the attack commenced are, without a solitary exception, vomiting and the coldness of skin. Purging, so often and invariably a prominent symptom of Bengal cholera, has not been observed until at a later period, when the disease had lost its virulence. Afterwards cramps of the limbs speedily follow,—the stomach refuses to retain anything. The skin is bedewed with a cold clammy perspiration, the pulse imperceptible, the voice is indistinct, insensibility comes on, and ultimately the patient dies. These are the symptoms observed in the cases which terminated fatally in hospital."

Of the haze in which the various propositions as to the origin and diffusion of cholera are, I shall only notice one or two points. The commencement of cholera in the standing camp at Kurrachee is well known; and, as far as can be judged, had a distinctly atmospheric origin in a place and among persons specially predisposed by existing circumstances for its localization. This was an instance in which a large number of persons were attacked in a few days. But there are many other instances in which cholera passes over stations, only attacking some few persons specially predisposed to its influence. It must be remembered that specific diseases are produced by certain causes; or in other words, that every specific disease has a *peculiar directly exciting cause.* It is not necessary to affirm that the exciting cause of disease should in every case be known as it is in itch. In cholera at least, the exciting cause is sufficiently well known by its effect. It is only, I believe, after we have determined to look out specially for the causes of specific diseases, and to examine them thoroughly, or after we have resolved to view every effect as produced by some certain cause, or some concurrence of certain causes that we may hope to arrive at any completely rational system.

It has been objected, on the score of its uncertainty, to call Medicine a science, or one of the exact sciences; but Medicine doubtless is an exact science, though at the present day we have not the data for proving it. Did medical men know the antecedents and constitution of a patient affected with any disease, his family medical history, the exact cause and course of the disease, and the precise action and power of each remedy, they would be able not only to cure every patient, but to do all in each case that could be done, and could determine what would in every case be the result. It is this exact knowledge that we are striving to attain. Data are being added constantly to the sum of our present knowledge, which, at some future time, may enable a fairer fabric to be raised; and by the elimination of general principles, the building of Medical Science will not only be exact but far simpler.

The most important part of remarks on cholera bears reference to treatment, and as yet the field is quite open. Empiricism and the search for specific cures have failed, and most lamentably. In his "Vital Statistics of the Armies of India," Dr. Ewart has shown that the proportion of deaths to treated is now very considerably greater than it was some twenty years ago. At page 149, he says: "Thus from 1818 to 1835 inclusive (eighteen years), out of 1,000 attacks, 263 deaths are recorded to have occurred in Bengal; but from 1836 to 1853-54 (also eighteen years), the mortality in a similar number of cases, reached 397, which shows an increase of 134 deaths. From 1818-19 to 1835-36 inclusive, the mortality per 1,000 admissions amounted to 216 in Bombay; but during a period of similar duration, from 1836-37 to 1853-54 also inclusive, it rose to 411, which demonstrates an excess of 195 deaths. From 1829 to 1838 inclusive (ten years), 271 deaths occurred out of every 1,000 admissions in Madras; but from 1842 to 1851-52 the average number of deaths amounted to 502, which exhibits the astonishing increase of 231 casualties." These statements at once prove one of three points, either: 1*st*, that our present treatment is worse than was that of our predecessors; or 2*nd*, that the disease is more virulent and less amenable to treatment; or 3*rd*, that the constitutions of those whom we treat

are much less able to bear up against the cholera poison. There are no means of determining from which of these three causes, or whether from two or more combined, this greatly increased mortality has resulted; but the fact remains, that the proportion of deaths has vastly increased.

I do not think that the object to be held in view in treating cases of cholera can be better expressed than in the words of Dr. Morehead:* "Extensive clinical acquaintance with epidemic cholera leads the unbiassed mind to this conclusion: That there are degrees and stages of cholera, as of other zymotic diseases, which are beyond the direct resources of medical art; and that in the management of them the physician best consults the interests of humanity and the character of his profession, when he abstains from rash and reckless empiricism, and is satisfied with placing the patient in those circumstances most favourable for the revival of vital action, under the influence of their ordinary stimuli. That, on the other hand, there are degrees and stages of the disease which are frequently readily controlled by medicine, and that these demand careful study and attention." Dr. Morehead's remarks are of the highest importance, and his reported cases are, I think, the most valuable on record, more especially with regard to what may be designated the fourth stage of cholera.

The mode of treatment which I propose considering has reference to the four stages of the disease; and with regard to the first stage, I may allude to the almost universal diminution of ozone in the atmosphere of localities where cholera is present. Ozone is oxygen in an allotropic condition, or in a state to be easily assimilated by substances or organs with which it is brought in contact. It has been supposed by some that the absence of ozone is the exciting cause of cholera. No certain evidence of this has been shown; but that there is some connexion between deficiency of ozone and severe cholera epidemics is almost certain from the constancy with which the deficiency is noted, when observations are made in districts where cholera prevails. I do not think that the diminution, or almost absence of ozone from the atmosphere is *per se* the exciting cause of

* Researches on Disease in India, 1856, Vol. I., p. 403.

cholera, any more than it is of any other zymotic disease; but that an atmosphere in which ozone is present in very small quantity, either predisposes the persons exposed to the action of the cholera poison, or by the non-oxidation of the gases, resulting from the decomposition of organic and other matters, the atmosphere in which these gases exist is specially suited to the concentration and it may be the reproduction of the cholera poison. This diminution or absence of ozone in an atmosphere in which a patient is dying asphyxiated, furnishes one great indication of treatment during the first three stages of cholera.

The first stage is generally amenable to treatment, and the diarrhœa may usually be checked by any of the more common methods: astringents, with one or two full doses of laudanum, are, in the majority of cases, sufficient to control the purging. Stimulants, either of the alcoholic or ammoniacal class, may be used with the other means advantageously. In treating these choleraic diarrhœa cases, it must never, for an instant, be forgotten that some of them may run on to the second stage, hence the practitioner must be careful not to administer remedies which, in the event of the disease not being at once checked, may embarrass him by having locked up the secretions by a too free use of opium, or carbonized the blood by too much of the alcoholic stimulant. Again, regard must be had to the stoppage of the action of the liver, which will certainly take place if the disease goes on to the second stage; and, I think that always at this early stage of choleraic diarrhœa it would be well to urge the liver to increased function by the administration of a full dose of calomel in powder. It is not advisable to administer pills in any stage of cholera, because the excessive vomiting is very likely to remove the pill in an unaltered condition, and medicines thus administered have no chance of exerting their influence. A sinapism to the epigastrium is also not unfrequently useful in this and the next stage by determining blood to the surface. Cold or iced water should also be freely allowed as drink. If all efforts are unsuccessful in arresting the disease at this stage, the treatment during the next must be considerably modified.

In the second stage, or that of true cholera before collapse has set in, the same consideration with regard to the use of opium

should have greatly increased weight. We have more than ever to fear the entire shutting up of secretion, and already that change, with respect to the blood corpuscules being unable to assimilate oxygen, has commenced to go on to its full development in the stage of collapse. Already at the stage of incipient collapse of Dr. Robertson, the salts are perceptibly diminished in the blood, but the mere statement of the analysis does not fully express the diminution that has taken place in the salts, for it must be remembered that the whole quantity of the blood is greatly diminished owing to the excessive discharges which have taken place. Hence we must conclude that the total quantity of the salts is decreased, and regard must be had to replacing them as a part of the treatment. A leading indication of treatment, besides endeavouring to stop the drain of serum, must be to try to keep open the secretions, more especially of the bile, and to prevent the blood going on to that de-vitalised state, which so fully obtains in the stage of collapse. Astringents are of very little use during this period of the disease, and both alcohol and opium must be laid aside, or used with the greatest caution. The first of the indications above adverted to, will, I think, be best obtained by the repeated administration of calomel, perhaps even by the heroic doses formerly in vogue. My opinion on this point receives strong confirmation from a case which occurred at Sholapore in 1854. Some ten cases of cholera had happened within as many days in a circle of two hundred yards. I was called up about 3 A. M. to see a weakly European woman, who had been attacked about an hour before with purging of thin, watery stools, cramps, and vomiting. The stools had unfortunately not been kept. The countenance was anxious, pulse small, &c. She was quite well when she went to bed. I ordered five grains of calomel, with half a grain of opium, to be given immediately, and repeated every hour. A sinapism was also ordered to be applied to the epigastrium. I saw her again at 5 A. M. She had had several stools of the usual choleraic appearance during the first hour, but none since. At half past 6, I again saw her; she had taken 3 doses of calomel and opium; there had not been any more purging or vomiting; some cramps remained, but less than they

were. All the glands of her mouth were swollen, and ptyalism was commencing. In the evening of the same day, the patient could not open her mouth, so severe was the salivation. The medicine had not been continued after the third dose at 6 A. M. Every urgent symptom of cholera disappeared after the salivation set in. This is the only case of cholera in which I have seen salivation occur almost at once; and why it should have come on so suddenly, probably depended on some idiosyncrasy of the patient. But with the salivation the symptoms of cholera ceased. This case may be considered to have set in without any appreciable simple diarrhœa stage, and at the time of treatment to have been in the early part of the second stage. Since the above case was noted, I have heard from Mr. W. C. Roe, of H. M.'s 89th Regiment, that, in several cases of cholera in the Crimea, early salivation set in, and thereupon the cholera symptoms always ceased. One word may be added with reference to "heroic" doses of calomel. It must not be forgotten that part of the medicine administered in cholera is expelled with the contents of the stomach, and it is not improbable that "heroic" doses of twenty grains were, as a general rule, reduced by vomiting perhaps to five grains.

The second indication at this stage of cholera is to prevent, if possible, the blood getting into the deoxygenized or devitalized state. The respiration must be promoted by every means in our power; but this will not be sufficient. I think we may, with very considerable hope of benefit, administer, with the cold or iced water, some oxygen-furnishing compound. There are several which may be administered in the water itself. Water saturated with *oxygen* or *nitrous oxide gas* may be given in any quantity to quench thirst. A small quantity of chlorate of potass, hypermanganate of potass, or carbonate of soda, may be dissolved in the water, and may have the double effect of supplying salts to the serum and oxygen to the globules of the blood. Stimulant draughts containing liquor ammoniæ may probably be given with advantage, acting not only as a direct nervine stimulus, but, when absorbed, withdrawing a small portion of carbonic acid from the blood. At this stage sinapisms are not of much use, as far as I have seen; but some officers of

Crimean experience speak with confidence of the benefit occasionally derived from the counter-irritation produced by burning a piece of paper soaked in alcohol over the epigastrium, which has a much more powerful effect than any sinapisms or similar epispastic. This mode of applying counter-irritation leaves no unpleasant odour of any kind. If coldness has commenced, hot dry heat should be applied to the surface of the body.

In the third stage, the treatment must be further modified. Our attempts at removing the disease or stopping its course must be abandoned, and we must only endeavour to restore the healthy action to the blood. In many instances nature herself apparently does this; but in all we should endeavour to carry out Dr. Morehead's directions, the physician abstains "from rash and restless empiricism, and is satisfied with placing the patient in those circumstances most favorable for the revival of vital action, under the influence of the ordinary stimuli." The blood circulates with great difficulty, and is, I think, not at all amenable to medicine ; but the indication so often alluded to of supplying it with oxygen, through other than the ordinary channel of atmospheric air in the lungs, may fairly, under this head, be persevered in. This may, I think, most advantageously be done by supplying the patient with an unlimited supply of oxygenated drink.

I may here mention some trials of this plan of giving an unlimited quantity of water saturated with *nitrous oxide*, which, though far from conclusive in a medical point of view, yet establish certainly the innocuousness of the remedy when given as a drink to patients suffering from cholera. Towards the end of the cholera epidemic which visited Bombay in 1857, I prepared a large quantity of water saturated with *nitrous oxide*, by passing the gas evolved from the distillation of nitrate of ammonia through a large Wolff's apparatus charged with water. The fluid in the first bottle was not used, and, after complete saturation, the liquid in the others was preserved ready for use. Its taste was somewhat sweetish, but not disagreeable; and of seven patients to whom it was given as a drink, one complained that he did not like it, but the rest all said it was agreeable. The usual treatment of the collapsed stage—hot bottles—was

prescribed, and light nourishment without alcoholic stimulants given. Four of these patients were admitted in a state of collapse,—one more in incipient collapse, from which he recovered. The general result of the whole was, that six of these patients recovered, and one died. The patient who died was in a state of collapse so advanced that the Apothecary of the J. J. Hospital did not administer the oxygenated drink, but it was tried next morning, and the patient rallied somewhat, but died in 48 hours. These experiments are not satisfactory, owing to the advanced period of the epidemic, but they are sufficient to warrant a further and more extended trial. I only mention them in this cursory manner, as I do not think it safe to place cholera experiments on record at a period of the epidemic when the tendency is generally to recovery. But these seven cases made me think hopefully of the remedy, and certainly proved that the administration is not attended with any danger.

With regard to the employment of chlorate of potass. A writer in a medical periodical has lately stated, from personal experiment in health, that it has a tendency to produce determination to and congestion of the head. It must be remembered that the physiological effects of remedies are not unfrequently different from their therapeutic, and the recorded experience of Christison and others makes no mention of such an effect.

The application of dry heat, by means of hot bricks, to the different parts of the body is the chief adjunct in treatment. Hot bricks, covered with a flannel and heated sandbags, are among the best plans. Hot-water bottles are equally good. The application of the sheet wrung out by boiling water, recommended by Dr. Barwell to be wrapped round the patient, has not proved successful in India. It seemed to me, in the only instance in which I tried it, to hasten the fatal termination in a very marked manner. Apparently it caused a very great increase of perspiration, and hence seemed to render the blood still more incapable of performing its function. The same result has occurred in the hands of others. Light nourishment must be given throughout the second and third stages, but only when it does not increase the irritation present in the stomach.

The fourth stage of cholera is one that must be treated on general principles, as it is most commonly found that one or more of the important organs are implicated in a greater or less degree. Little or nothing of the specific cholera disease remains, and the best plan is, I think, that recommended by Dr. Morehead, to allow the system gradually to recover itself, giving such aid as may, in each particular instance, seem demanded.

The analyses of the urine, already quoted, would seem to point to crises taking place at particular days, when the kidneys increase their secretion in a very large ratio. Dr. Robertson has recommended the use of diuretics in the stage of reaction, from the fact that urea has been found in the blood at this time in greatly increased quantity.

I have thus sketched what should, I think, be the outlines of the rational treatment of cholera. In the earlier stages of cholera many cures have been wrought by medicines which, on continued trial and in different stages, have exerted an influence the reverse of beneficial. Chloroform given internally, at about the end of the second stage, has, in some instances, seemed to act most beneficially, but at other times has even seemed to increase the irritability of the stomach. It is less objectionable than alcohol in any form; for it abstracts much less oxygen from the blood; nay, when mixed with venous blood, it seems to have the power of restoring its deep crimson color. I have not referred to the inhalation of chloroform, though some successful cases have been reported, but confirmation by other and more continued application of the remedy is required. The inhalation of oxygen gas has been proposed, but it has not been sufficiently experimented on to determine its value. It is always most difficult to make experiments of this kind on patients who are so ill as those suffering from an advanced stage of cholera. The hypothesis on which they are administered is sound, but as yet it has not been proved whether the lungs, in patients affected with cholera, are enabled to absorb more oxygen when inhaled pure than in the case of the simple atmosphere. If oxygen could be administered in a nascent state, as ozone, benefit would in all probability accrue. It may be objected to the plan of treating cholera which I have advocated, that it is

attended with very great difficulty in the mode of preparing oxygenated drinks. This is quite true at the present time, but should this method of treatment, after a fair trial, appear to be attended with benefit, I have not the smallest doubt that chemistry will step in to aid us with compounds offering all the benefits of oxygenated drinks, which could either be prepared on the spot, or kept in readiness. It would be comparatively easy to prepare an effervescing water highly charged with *nitrous oxide*, and to keep it in the same way as soda-water. I should also suggest that a very weak solution of chlorate of potass, decomposed with dilute sulphuric acid, be prepared, and examined as to the safety of its administration. This mixture would, I have no doubt, furnish us with a compound affording oxygen in an almost nascent state; but experiments are, I think, required on the point. Since the above was written, I find that a somewhat similar compound has been used in England in the treatment of diphtheria. There are many other compounds which might be used with the same end in view.

It would be almost superfluous to mention what are the sanitary precautions to be taken with respect to the prophylaxis of cholera, and also as to the prevention of its spread. Few will now deny that it does not, in many instances, spread by infection. The late lamented Dr. Alison, Dr. Budd, Dr. Laycock, and many others, furnish incontrovertible evidence, that it may be propagated by the effluvia arising from the decomposing dejecta. Dr. Lauder Lindsay has proved that its decomposing fluid causes a peculiar cholera in some of the lower animals, when introduced into the alimentary canal. The late Dr. Snow labored successfully to prove how it might spread from the ingestion of water contaminated by sewer and other emanations. It is well known that, when the epidemic influence is abroad, a simple purgative may produce an attack of true cholera. All these facts point significantly to the course we ought to pursue in our attempts to stay the spread of cholera.

At the commencement of these remarks I mentioned that the essays and histories of epidemics of cholera were multitudinous; but the subject is still unexplained. I think the student of medicine should go on recording the circumstances of every

epidemic that falls under his notice, and recording all without reference to preconceived views. Any researches into the nature of cholera may, for the present, on account of difficulty and long-continued disappointments, seem comparatively useless; but I firmly believe, with Dr. Charlton, that "at some future time, no doubt, all these researches will be of value, when the master-mind shall arise to elicit, from the mass of reliable documents and records, the true nature, pathology, and, perhaps, even the appropriate treatment of cholera."

Postscript.—Since the foregoing remarks on the treatment of cholera were written, a period of ten months, I have only seen three cases of cholera. Two of them, through the kindness of Dr. John Ogilvy of H. M.'s 33rd Regiment, under whose care the patients were, and the third, a sepoy of the Erinpoora Field Force, attached to the guard of the Agent of the Governor General for the States of Rajpootana.

Aboo has frequently been named as one of the places exempted from cholera, nor do these three cases damage its character in that respect; for, the first case which occurred supervened within 16 hours from the arrival of the officer on the hill after passing through a district where cholera was very prevalent; the second occurred within 36 hours after passing through the same district; and the Bheel, the subject of the third case, had only arrived on the hill about 8 hours, having just previously attended a relative who died of the disease at Anadra (the village at the bottom of the hill), where cholera was raging.

The first case was, in the early diarrhœa stage, treated ineffectually with chalk and opium. Collapse set in after 6 hours' diarrhœa, and all the usual symptoms of cholera were present. The collapsed stage was treated with large and frequently-repeated doses of calomel, sinapisms to the epigastrium, effervescing draughts with chloroform, and from the third or fourth hour of collapse, with as much as he could take of Liebig's invalid soup (cold fluid extract of flesh). He had also about ℥iii or ℥iv of champagne altogether. The collapse was severe and lasted for 13 hours. The vomiting was not urgent after the first dose of effervescing draught with chloroform,

nor did vomiting or sickness at any time appear to be produced by the cold soup. Some hours after reaction set in, there was return of the urinary secretion. The case did well ; there were no secondary symptoms, except a smart attack of gastritis on the third day, which was subdued by ordinary means. It is not impossible that this gastritis was caused by the calomel administered.

The second case was milder, and was treated with calomel, effervescing draughts with chloroform, cold soup, and sinapisms. The collapse was slighter than in the preceding case, but longer continued. At no time, as far as could be judged, did the cold soup cause sickness or vomiting. The case recovered without any untoward symptom.

The third case was treated in precisely the same way as the second. Collapse supervened early and continued for nearly two days, when slight reaction set in, and the secretions were gradually restored. Diarrhœa continued for some days after the symptoms of cholera were subdued, but there was no other sequela to the cholera. The cold soup never caused any vomiting in this patient.

In each case, besides the remedies named, artificial heat (dry) was applied to the limbs and body as long as the collapse continued.

I place these cases on record as having been treated almost without opium (the first only had a little in the early stage); calomel was freely given in gr. x doses, and repeated again and again. The trial of the cold soup was determined on by Dr. Ogilvy and myself in consultation on the first case, and its effect seemed sufficiently well-marked and favorable to warrant its continuance. It was at first given in ℥i doses, afterwards more largely. It was made, as recommended by Liebig, by placing finely-minced lean meat in cold water, to which a little salt and a few drops of muriatic acid had been added. The meat used was that of sambur, sheep, and fowls, as fresh as possible. No alcoholic stimulants beyond the one or two glasses of champagne in the first case were given. The chloroform was given in effervescing draught, chiefly as a stimulant sedative to allay vomiting.

Aboo, November 1861.

ON THE HILL DISTRICTS TO THE SOUTH-WEST OF MEHUR IN SIND.

BY ASSISTANT SURGEON J. LALOR, A. B., SIND HORSE.

Presented August 1860.

The "Dunna Towers," built on a ridge of the great Halla range, are situated about fifty miles to the south-west of Mehur, and in that Deputy Collectorate.

After considerable inquiries, especially instituted within the last few years, with the object of procuring a cool retreat during the intensely hot months of summer, this place was selected as offering the greatest probabilities of success.

Considered with reference to the surrounding country, it will be found, after an irregular, rugged, and occasionally steep ascent, to overlook all that north-eastern portion of the valley of Sind to which it forms a barrier, and to be again overlooked by those higher ranges of which the "Khara Tuckha" is here the natural and impassable boundary between Sind and Beloochistan. For about thirty miles to the west of Mehur, a straight road has been marked out, leading, for the most part, through a desert country, and dependent for cultivation on the mountain torrents. The soil appears to be a fine, rich, brown loam, with apparently a considerable alluvial substratum, from the repeated washings of mountain-streams. The absence of vegetation is but seldom, and only relieved by patches of stunted tamarisk.

Of the remaining twenty miles, fifteen are through irregularly winding gorges, mostly river beds, covered with diluvium, and occasional huge boulders, and up the gradually-ascending slopes of the lower range. This is an exceedingly bad and disagreeable journey at present, but more particularly in the latter portion, where it takes a southerly turn, as here a free current

of air is shut out by the now uninterrupted line of hills, while the rocks on either side radiate a powerful and almost stifling heat.

On the wayside, are some bold and striking overhanging cliffs, a few reaching a height of fully one thousand feet. This lower range appears to be all of the red sandstone formation of vast horizontal or sometimes slightly oblique stratification, and invariably dips eastward towards the plain. Occasional beds of yellow clay and marl are met with, the evident result of "denudation" of the upper ranges.

Those hills are in every direction intersected by innumerable watercourses, and evince powerful and repeated water action. The ascent from these to the middle ridge, on which the Towers are built, is very abrupt and laborious, though apparently practicable and safe for hill ponies. It is altogether about five miles. The first two over a solid rock of close-grained sand and limestone, about fifteen hundred feet in elevation, thence through the bed of a nullah, flanked on either side by masses of loose sandstone and marl, containing nummulites in large quantity, and in a free state—"detritus from the higher ranges." The remaining three miles to the "Towers" are very steep and up the middle ridge, the most marked peculiarity of which is, that it dips at an angle of about 45° westward, or in a contrary direction to the lower one just described, and to the upper or "Khara Tucka" immediately beyond. It is, as approximately ascertained from the boiling point of water, about 4,500 feet above the level of the sea, and mainly composed of nummulitic limestone, with the accompanying nummulites and testaceæ, occasionally varied by bits of quartz, imbedded nodules of carbonate of lime, and pyrites.

Immediately beyond, and striking more directly N. and S., is the "Khara Tucka," six thousand feet high at least. This dips eastward at an angle of about 30°, shows considerable traces of water action along its side, and at either flank a huge cliff of fully five thousand feet. These appear to have been either corroded away by water action, or else thrown off in a convulsion of nature with some violence, altering the strike to N.E. and S.W. They appear very imposing, especially at early morning, but access to them is difficult, particularly that to the S.W.

"Khara Tucka" overhangs Herar, a pretty little valley, about three miles S.W. of the Towers, containing an abundant supply of water. It is a place of some importance in the hills, was once intended by the Ameers of Hydrabad as a secure retreat, and still shows the half-finished walls and gateways of a fort. At a comparatively early era of creation, this valley must have been inhabited, and curious remains of a by-gone age are seen in the "Kaffir Kotes"—regular and evidently artificial ranges like "river terraces."* They were probably intended as sites for huts and tents, but it would be impossible ever to ascertain how they were formed. The popular belief is, that those huge boulders were lifted into position by the giant race then inhabiting the earth, or they may have been arrested in their descent from the higher ridges by some artificial† contrivance. But, whatever may be the theory of their formation, they are strange and imperishable though indefinite memorials of an age and race long since passed away.

The soil here, as in every place I have seen it in the hills, is a yellowish-red marl, derived no doubt from the disintegration of the rocks, and washed into those plateaus by the water; it is apparently very rich and, in the season, under cultivation. At the time of our visit, a small patch of indifferent "Jowaree" was on the ground. Excellent water can be always had from Herar; but the road is difficult. The rivulet, on leaving the valley, is lost to sight beneath the rocks for nearly half-a-mile, re-appearing in a fine gushing stream, at fully three hundred feet of a lower level than the point of its disappearance. There seems little doubt but that it still retains the original bed, and that the superimposed rock is of a comparatively late formation, and in many places composed of petrified vegetable matter and

* These terraces were for purposes of cultivation; they caught the rain-water running down the face of the hill, also "detritus," thus forming slight soil, in which the people sowed jowaree or wheat, according to season. The practice is common now all over Afghanistan and the Himalayas, and was so throughout Beloochistan when it was more densely populated than at present. The inhabitants of these days are always styled "Kaffirs," hence these terraces and other remains are called "Kaffir Kotes."—*Note by Major Merewether.*

† Most probably accidental, and taken advantage of by the inhabitants to form the terraces.—*Ditto.*

"débris." Large masses of this structure, with dull, hollow resonance, may be occasionally met, which, on fracture, give the appearance of tube and fibre,—unmistakably vegetable. Few sights are more curious or picturesque than the course of this rivulet, which, up to the point of its disappearance in the valley, exhibits no higher organisation than the "leech;" while here, at its escape from the rocks, it teems with animal life varied and advanced in the scale of nature. Amongst these are many kinds of fish, similar apparently to the roach and perch, crabs, cray-fish, and myriads of minute articulate animals.

The lofty, overhanging crags on either side are studded with flowers of various colours. In the bed of the stream are some huge, grey, limestone boulders, often twenty feet high, and as many in circumference, with masses of conglomerate, showing that once a mighty torrent must have swept down those mountain sides. Some beautiful ferns, amongst them "*Trichomanes*" cover the edges of the spring, and a few well-known trees in Sind—the siris, peepul, babul, peloo, and fig, together with the pink oleander, large reeds, and a stunted variety of bamboo—appear to be indigenous, though not flourishing in this place. On leaving the rocks, the stream winds through the intermediate valley, and is lost amongst the lower hills, affording at one place—Ut-ke-Pere, about four miles from the Towers—excellent drinking-water. Several attempts have been made to procure a supply of water in the immediate neighbourhood of the Towers, and two tanks, partially excavated, will test the possibility of retaining the rain-water in a convenient situation. According to the hill-men, the water after a wet season, lodges for four or five months in any place with a favourable watershed. The general aspect of the Hills is wild and barren; but thousands of sheep and goats find herbage amongst the stunted shrubs and trees. Of the latter, there are few of any size, and actually on the Hills themselves, none approaching the dignity of forest tree. The chief are the *Salvadora indica*, "Peloo," and *S. persica*, "Kusseer," which curiously insinuates its roots into the rocks and grows to some size. The leaves and peduncles contain numerous follicles of essential oil, which emit a heavy and disagreeable odour when pressed, and the fruit is exceed-

ingly pungent and tastes like mustard. Two capers—*Capparis aphylla* and *galeata*, "Kurreil" and "Kulvery,"—a variety of small "Lusooree," the "wild almond," and a small "Khamual shrub," with red, tasteless berries, afford eatable fruit. In addition to these, the two most remarkable woods in Sind grow here—the "Khow," *Olirum montanum*, and the "Loheroo," *Tectona grandiflora*. The former contains a close, hard, and finely-grained heartwood, and is much esteemed for turning purposes; and the latter—the hardest wood known—is extensively employed by the natives, and is the one from which the primitive Belooch guitars are made. This tree rarely grows to any size; but the fine, large branches of rich orange flowers are beautiful and attractive on the hill-side. Both trees are good marks of altitude, and are seldom found growing under an elevation of three thousand feet. Amongst the herbs are a variety of Catmint "Dathro," a pretty *Campanula Veronica* "prickly Convolvulus," and many and uninteresting varieties of *Argemone*, and thistle. But the most universally useful plant in the Hills is the *Chamærops ritchiana*—a kind of under-sized fan-palm known as the "Pees." From the leaves of the "Pees" are manufactured ropes, mats for the walls and roof of huts, and sandals, and the decayed parenchymatous tissue affords excellent tinder.

Few if any wild animals live in those Hills—a variety of badger, known to the natives as the "Gorput," being the only one with pretensions to the name. An occasional hyena or panther prowls down from the other ranges; but the circumstance must be rare. The "birds" differ little from those of the plains; the goshawk and vulture, a small variety of rock pigeon, and a beautiful little "swift" that appears towards evening and poises itself in the air with the greatest degree of elegance, a few partridges scattered here and there, are probably of a variety peculiar to the Hills. Few reptiles are found. A lizard of the genus Ignana, completely black (shining), and most unsightly, with extensible tongue and equal number (five) of fingers and toes, was the only strange specimen I saw. Snakes of a poisonous description do not I believe exist; and the only venomous animal appears to be a variety of the yellow scorpion.

Its sting, though very painful, is not I imagine dangerous. I treated two cases, in which the pain subsided quickly, and the inflammation was inconsiderable. I have not heard of any disease endemic to those Hills, and the people say they never suffer from fever. A great number of the Collector's people were troubled with a kind of "urticaria," which I attributed mainly to the want of vegetables.

Having thus briefly mentioned the leading topographical and natural features, the following remarks on the more important subject of climate, and the extent to which its physical characters are modified, will be more easily understood. It must be premised, that the meteorological experiments and observations embrace but a very short period of time—namely, the last fifteen days of June, and the first twenty-eight of July. It will be therefore perceived that there has been not only no opportunity of contrasting them with other seasons, but not even with other months of the year. The observations on temperature were taken from a thermometer suspended on the outer-side of the inner wall of a tent, opposite the door-way, and exposed to a free current of air; but during the month of July within the Towers, though otherwise under the same influences. The experiments on humidity were made with the ordinary thermometer, the bulb of which, enveloped in muslin, was kept wetted by the usual contrivance, and the indications, contrasted with the naked instrument, suspended alongside. The observations on solar radiation were taken also from the common thermometer, with attached metallic scale. The bulb was wrapped in dark cloth, and the instrument, with three or four folds of brown paper interposed, was laid horizontally on the ground, directly under the sun's rays. Not having had a self-registering thermometer, the indications must be received only as the limits of observations, and not strictly as the maxima or minima.

With regard to temperature then—the first and great element of climate,—the mean of sixteen observations, taken at 6 A. M. and 2 P. M. respectively, during the last fifteen days of June was 84°; the maximum 97°, and minimum 76°. The mean daily variation during the same time was 5°; the maximum 14°, and minimum 1° 30′. Solar radiation was

powerful, but tempered by cool breezes, setting chiefly from the N.W. during the first week, but afterwards from the E. and N.E. These latter days were particularly cool and moist, accompanied by light clouds and rain. The thermometer never rose about 78°, and the daily variation was a minimum. The nights were invariably pleasant—a few positively cold,—and in none could warm covering be conveniently dispensed with. High winds—cold, but otherwise of an exceedingly disagreeable nature—prevailed at the lunations in June. The small particles of sand and dust were swept along with a violence such as rendered walking or sitting in exposed situations very unpleasant. Shortly after the E. and N.E. breezes spring up, the valley below becomes covered with fog, appearing at first in small patches, but gradually spreading, and finally rising above the level of the Towers, seemed to settle along the top and sides of the Khara range. During the nights, a good fall of dew, and in the day a most grateful alternation of cloud and sunshine. A slight shower of rain on the 30th, and again the atmosphere became dry. During the month of July, as may be seen from the annexed table, the atmosphere was much more uniform, the temperature lower, and daily variation slight. There were none of those high winds so disagreeable in June. The first experiments on humidity show a powerful evaporation and unduly dry state of the air, the mean depression amounting to 28°. Owing to want of instruments, the observations were then suspended until the end of the month, when, as will be seen, a very considerable change had taken place, and the mean depression was only a few degrees. In July, there was a marked, but gradual and never violent transition from dryness to moisture, which gave to the month its decidedly agreeable character. The observations on solar radiation show a different result from what might have been expected, and opposed to the theory that "the calorific effects of the sun increase as we ascend." The greater clearness of the atmosphere and general absence of clouds seem to favour the theory. But the appended table by Mr. Wright, Apothecary, in charge of the Mehur hospital, plainly shows the statical effect of the sun's rays on the thermometer to be much greater in the plains. There is every reason then to suppose that the thermo-

meter can be only taken as a measure of the accumulated free heat, which will be greater in the plains, both from the wider extent of radiating surface and the forced accumulation from superincumbent pressure. The period of the highest range of the thermometer was between one and two o'clock,—about one hour earlier than the greatest maximum within doors. From the nature of the locality and absence of vegetation, the glare is considerable; but owing also to the greater purity and uniformity of the atmosphere, the sun's rays are never refracted in that dazzling "mirage," and the sickening effects of both the glare and solar heat in the plains are never experienced.

E. and N.E. winds were almost the only ones during the months of June and July. This great uniformity results, no doubt, from the vapour rising out of the plains, and carried against the sides of the mountain, causing some condensation—a vacuum,—and consequent rush of air in those directions. Once a southerly wind swept over the valley of Herar, and approached in effects the hot winds of the plains. Rain came on towards the end of June. The vapour upraised from the plains formed for days, with low and continued mutterings of thunder, along the Khara, and at last fell in all the bright tints of a summer evening's shower. During the month of July, those grateful and refreshing showers were of constant occurrence. The amount of heat evolved in condensation was curiously demonstrated in the occurrence of a hot wind immediately following the subsidence of the rain. The thermometer suddenly rose from 70° to 84°, and as quickly fell again. The accompanying tables show comparatively the temperature of the Hills and Plains during the months of June and July. It must be observed that the Hospital tables, though embracing the most important indications—6 A.M. and 4 P.M.,—do not show the greatest maximum, which is about 2·30 P.M.

Meteorological Register for the month of June 1860 *at Dunna Towers.*

June.	Thermometer in Air.		Wet Bulb.		Solar Radiation.		Winds.		Remarks.
Date.	6 A.M.	2 P.M.	6 A.M.	2 P.M.	9 A.M.	4 P.M.	Direction.	Force.	
15	81°	89°	60°	68°	..	128°	N.W.	Brisk.	Very dry and parching.
16	82	84	60	56	..	..	Do.	Do.	
17	81	87	..	..	..	..	Do.	High and strong.	
18	80	86	..	..	130°	..	Do.	Stormy.	Tents carried away.
19	77	84	..	..	130	144	Do.	Do.	Day continued very stormy and disagreeable.
20	86	95	..	..	..	..	Do.	Do.	
21	84	97	..	..	..	136	Do.	Dull.	
22	80	87	..	..	..	..	W. and N.W.	Calm.	
23	82	86	..	..	..	115	N.E.	Cool.	
24	84	89	..	..	..	147	N.W.	High and strong.	
25	83	92	..	..	..	130	N. and N.W.	Calm.	
26	80	94	..	..	..	128	N.N.E.	Light and variable.	Clouds to S. W.; heavy dew at night.
27	78	84	..	..	..	130	N. and NE.	Light.	
28	76	78	74	72	..	135	Do.	Do.	Heavy fog in plains, mounting towards the hills.
29	77	82	72	73	..	132	E.	Do.	
30	76	78	74	74	..	112	E.	Do.	

Meteorological Register for the month of July 1860 at Dunna Towers.

July.	Thermometer in Air.				Wet Bulb.		Solar Radiation.		Winds.		Remarks.
Date.	6 A. M.	9 A. M.	2 P. M.	5 P. M.	9 A.M.	3 P.M.	1 P.M.	4 P.M.	Direction.	Force.	
1	79°	79°	83°	83°	77°	72°	132°	110°	N.E.	Variable.	Mutterings of thunder, and few drops of rain.
2	79	82	88	89	70	65	137	118	N.E.	Light.	Thunder at 3 P.M.
3	83	83	92	91	62	61	142	131	N.	Do.	
4	84	84	88	88	62	61	130	124	E.	Do.	Still; rain clouds N.
5	86	89	90	91	61	61	125	124	N. and N.W.	Brisk.	Do. do.
6	84	91	92	91	61	62	146	109	N.	Calm.	Heavy clouds (strati).
7	84	86	92	93	57	60	146	126	N.W.	Brisk.	Strong wind during night (cold).
8	80	82	91	92	58	59	140	128	N.W.	Light.	Calm and pleasant.
9	79	85	90	89	59	61	144	126	N.E.	Do.	Do.
10	74	82	83	84	56	66	135	121	N. and N.W.	Light.	Fog beginning to form up.
11	80	85	87	88	60	57	142	130	N.	Do.	Fog forming up.
12	82	86	88	89	62	60	140	128	E.	Do.	Do.
13	92	96	97	97	..	..	..	..	S.	Calm and hot.	In the valley of Herar, about one thousand feet lower than the Towers.
14	92	92	93	93	..	..	..	..	E.	Light.	
15	80	82	82	82	71	70	..	..	N.E.	Cool and pleasant.	
16	81	82	84	84	..	..	..	..	S.	Cool.	
17	78	78	82	83	71	71	120	112	N.E.	Light.	Dew last night.
18	75	78	81	82	71	69	126	105	N.E.E.	Brisk.	Dew last night, rather heavy.
19	79	79	82	83	66	66	131	122	N.E.	Do.	
20	81	83	87	87	66	66	131	128	N.W.	Light.	Clouds S.W.
21	83	84	87	87	68	61	130	120	Do.	Do.	Lightning.
22	84	85	87	88	68	72	133	120	Do.	Do.	Heavy electric clouds over the Khora.
23	83	83	80	80	72	72	118	112	N.E. and E.	Do.	
24	79	76	78	80	72	70	115	111	E.	Do.	Do. do. do.
25	77	78	82	83	69	72	110	110	E.	Do.	Rain—a beautiful shower.
26	79	79	84	84	71	70	127	117	E. and N.E.	Do.	Thermometer fell to 68°. More rain.
27	79	79	83	85	71	71	127	118	Do.	Do.	A good fall of rain at 6 P.M. A little rain; very pleasant.
28	72	75	85	85	70	71	115	112	Do.	Do.	
29	..	..	..	..	..	..	..	..			
30	..	..	..	..	..	..	..	..			
31	..	..	..	..	..	..	..	..			

Meteorological Register kept at Jacobabad, for June and July 1860.

1860	Min.	Winds.	Max.	Winds.	1860	Min.	Winds.	Max.	Winds.
June					July				
1	93°	SW	102°	SE	1	89°	SW	103°	SE
2	89	SE	102	SE	2	91	SW	102	SE
3	83	SW	102	SW	3	91	SW	109	SE
4	84	SE	104	SE	4	91	SW	105	SE
5	84	SE	104	SE	5	90	SW	105	SE
6	85	SE	102	SE	6	90	SE	105	SE
7	85	SE	104	S	7	91	SE	104	SE
8	85	SE	104	S	8	91	SW	105	SW
9	89	SW	105	S	9	91	SE	103	SW
10	89	SE	104	S	10	90	SE	101	SE
11	88	SE	104	S	11	91	SE	101	SE
12	90	SE	104	S	12	90	SE	100	E
13	92	SW	102	SW	13	90	SE	104	SE
14	85	SW	102	SE	14	90	SE	104	SE
15	85	SW	102	S	15	90	SE	103	SW
16	85	SW	102	S	16	90	SE	100	SW
17	87	SE	102	SE	17	90	SE	100	SW
18	87	SE	102	SW	18	90	SE	100	SW
19	89	SW	102	SE	19	92	SE	102	SW
20	86	SE	102	SE	20	91	SW	102	SW
21	90	SE	102	SE	21	91	SW	103	SW
22	90	SE	102	SE	22	91	SE	104	SE
23	90	SW	109	SE	23	90	SE	100	SE
24	92	SW	110	SE	24	88	SE	100	SE
25	92	SE	110	SE	25	91	SE	101	SE
26	93	SW	110	SE	26	92	SE	106	SE
27	90	SW	99	SE	27	92	SW	100	SW
28	90	SW	99	SE	28	89	SW	101	SW
29	90	SW	100	SE	29	83	SE	90	SE
30	91	SW	104	SE	30	88	SE	93	SE
					31	88	SE	94	SE

Range of Thermometer at Mehur.

Date.	In the Shade.	Under the Sun.			
	12 Noon.	1 o'clock.	2 o'clock.	3 o'clock.	4 o'clock.
1860					
July 16th	99°	153°	150°	140°	....
,, 17th	99	150	147	136	120°
,, 20th	104	153	145	131	125
,, 21st	103	157	148	122	120

According to the tables just given, the temperature, even during the hottest months of the year—June and July,—bears a very strong and favourable contrast to that of the plains.

But it is the modifications of the other physical conditions of climate—the buoyancy and elasticity of the atmosphere, owing to its escape from such enormous superincumbent pressure—that constitute its most pleasant feature.

This is the first thing that strikes a stranger on visiting the Hills, and enables him to take an amount of exercise without the accompanying feeling of lassitude, which, from a long experience of the plains, he would have believed impossible. The only hot months of the year I believe to be June and the early part of July. Once moisture prevails—as it did this season in July, and the natives say does always about the same time,—the climate becomes most equable and pleasant.

Having thus given a general idea of those Hills, together with their leading natural and climatic features, I would now beg to submit the advantages that may result from the inquiries lately made.

Previous to the investigations of Captain Dunsterville, the hot winds were believed to prevail all over those Hills, the mere elevation of which was only supposed to expose them the more to the trying effects of heat, glare, and radiation, and that the establishment of a Sanitarium or cool retreat was impossible. No doubt, in the present state of Upper Sind, a Sanitarium is not only unnecessary, but would, I believe, be injudicious, from the comparative solitude to which it would be doomed. The number of Europeans is very limited, and the facilities of reaching Kurrachee—which, in addition to a change of climate, affords the equally grateful one of society—sufficiently great for any one whose means can afford it, or services be dispensed with. But that such a place can be found is nevertheless of the greatest importance, in a remote aspect, should the vicissitudes of State ever require an increased establishment of Europeans.

The immediate benefit conferred by the present cool retreat, in enabling a certain number of Officers to carry on their official work, without that detriment to bodily and mental vigour, which

drives so many to seek a change before they have been more than a few years in Upper Sind, must be apparent.

The present accommodation at the Towers is unsatisfactory, and nothing but previous experience of the plains would induce any one to seek the change.

But a good deal has been done; a tank excavated,—sufficient, at least, to test the probability of obtaining water there; and the Towers, begun originally by the Ameers, have been roofed, and made into a comparatively comfortable state. A little more money, as judiciously expended, would not only procure for the Civil staff of the Shikarpoor Collectorate a healthy and beneficial change during the hot months, but would likewise be the means of obtaining valuable, and, perhaps, ultimately very necessary information regarding the climate, and other natural and physical features of all the Hill districts bounding the plains of Sind.

REMARKS ON THE MEDICAL TOPOGRAPHY OF BHOOJ, AND THE PREVALENT DISEASES AS THEY OCCURRED IN THE KUTCH LEVY HOSPITAL.

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Presented by the Principal Inspector General Medical Department.

The disbandment of the Kutch Levy appears a suitable period for offering a few remarks on the medical history of the corps during the time it was considered a medical charge, or from January 1st, 1858, to October 1st, 1860, a period of two years and nine months. Previous to entering upon this subject, a brief sketch of the topographical position of the cantonment of Bhooj, and a consideration of its relation to the supposed or known causes of endemic and other diseases cannot, I conceive, be misplaced. By the term Medical Topography may be understood the discovery of such errors as may lead to the improvement of a climate, and the consequent prevention of such diseases as may be clearly traceable to the deleterious effects of the latter. Hence, the consideration of the climate of a locality, situated so peculiarly as Bhooj, cannot be satisfactorily undertaken, without first glancing at the chief characteristics of the surrounding district, both geographical and geological; afterwards directing attention to local aspect, in which must be included cultivation; the presence or absence of trees; position and condition of buildings; drainage; and in short, all the labours of man, whether fulfilling his allotted duties as the Civil Engineer, the Sanitary Reformer, or the Meteorologist.

Sir James Annesley long since remarked, that there is no country in the world where there are greater vicissitudes of climate than in India, chiefly owing to the influence of surround-

ing localities; and perhaps there are few places where such influences are *seemingly* more apparent than the military cantonment of Bhooj, and indeed the whole province of Kutch.

This small State, situated between 22° and 24° North latitude, and 68°—70° of East longitude, is bounded on the north, east, and south-east by the Runn; on the south and south-west by the Gulf of Kutch, and the Indian Ocean; and on the north-west by the eastern branch of the Indus and the Runn.

According to Captain Raikes, formerly Acting Political Agent, the province contains about 6,500 square miles. Its breadth is about 50, and its length 170, and it contained a population estimated in 1853 at 409,522.

Commencing at the frontiers of the country, the first peculiarity which strikes the Medical Topographist, as exerting a decided influence on the climate of Kutch, is the existence of that large tract, previously mentioned under the term of "The Runn," as bounding the province on several quarters.

This, as is well known, is a flat sand-tract, varying in width from 25 to 35 miles on the north, north-east, north-west, and south-east, but at one point (due east) narrowing to about two miles only.

This immense surface appears, at some remote period, to have been covered by the waters of the ocean, which have since subsided, and are even said to be still imperceptibly draining off, and enlarging its extent. A different opinion, however, was expressed by the late Sir Alexander Burnes,[1] who could "scarcely believe the Runn was ever a portion of the sea," but "would rather suppose (notwithstanding the tradition of the natives that ships used to unload at certain points) that the sea had gained it from the land, than the latter from the former, as it is flooded by the water blown up from the ocean by the south-west monsoon." It would appear, however, that its periodical flooding is not only due to this cause but also to the monsoon rains falling into it, and to the swelling of the rivers—the Lonee, the Bunnass, and other smaller streams which empty themselves into it.

[1] Unpublished Manuscript by Sir Alexander Burnes, in the Bhooj Library.

Be this, however, as it may, the fact remains for the Medical Topographist that there is an immense salt marsh surrounding Kutch on three sides—in some places a sheet of shallow water only a few inches deep ; in others an impassable salt swamp ; here and there an unproductive bed of sand ; but in all parts strongly impregnated with muriate of soda, which, indeed, whitens the surface for miles in extent. The whole of this vast tract begins to fill with water, from one or other of the causes named, about the middle of April, and becomes impassable by the end of June or middle of July, beginning to empty and dry up by evaporation in August, and becoming by December more or less as just described.

All observation, from ancient to modern time, marks the neighbourhood of marshy ground as injurious and inimical to human health and existence. Instances of this deleterious effect are manifold. It is mentioned by Hippocrates [1] and Celsus. [2] It was in the low flat country of Hungary, abounding in marshes and stagnating ponds, that the Crusaders, when marching towards the East, lost half their numbers. [3] The Italian physcian Lancisi, [4] who, in 1695, wrote the first great original work on the subject, states that thirty gentlemen, on a party of pleasure, were exposed to the sudden change of a south wind from the putrid marshes, twenty-nine of whom were immediately seized with tertian ague. Before the marsh of Chartrense was thoroughly drained, twelve thousand persons were afflicted with fever, of whom 3,000 died, in one year. [5] Before the fens of Lincolnshire were attacked by the Civil Engineer, ague carried off numbers. [6] Were it not for the intervening forests of Cistura and Sermonetta, the Pontine marshes would decimate Rome. [7] The 18,000 men of the British army who perished at Walcheren were victims of this same malarious poison. [8] The unhealthi-

1 Hippocrates, Aphorism 57, Section 4.

2 Celsus, Liber iv.

3 Ency. Arts and Sciences, Art. "Medicine."

4 Lancisi, De noxiis paludum effluviis.

5 Martin, On the Influence of Tropical Climates.

6 Copland, Med. Dict., Art. "Fever."

7 Ranken, Trans. Cal. Med. Phys. Soc., vol. iii.

8 Wright's History of the Walcheren Remittent Fever.

ness of Arracan is attributed to miasm conveyed by the winds from the jungles of the Soonderbuns.[1] The deadly climate of Sierra Leone is accounted for by the marshy character of the opposite Bulam shore. The prevalence of fever, in many of the stations on the Indian Plains, may be justly referred to the impracticability of thorough drainage, the water, instead of passing away from the soil, percolating slowly through it, and evaporating from it, just as occurs to a greater degree in a drying-up morass: as, for example, after the inundation at Mooltan, the fevers arising from which must still be vividly recollected by, and probably are still the cause of suffering to, many officers of the Bombay army.

The Runn of Kutch is no exception to the facts here quoted. Indeed, it is considered that the exhalations from saline marshes[2] are more baneful in their effects than the malariæ arising from the evaporation of fresh water and decaying organic matter; and hence we find endemic disease most prevalent in Kutch at that period when the six thousand square miles of Runn are in process of drying, or during the months of October and November, and particularly so when the northerly wind blows directly from the marsh across the province.[3] The records of the Kutch Levy, although extending over so short a period, illustrate these remarks.

Although we know from bitter and dearly-purchased experience that there is a mysterious agent, which we call miasm or malaria, arising from salt marshes, from fresh water marshes, from decaying organic matter, from undrained surfaces, and from several other conditions hereafter to be referred to, we are still totally unaware of the precise nature of this deadly poison. Our finite senses are unable to perceive it. Chemistry, which can detect the eighth-thousandth part of a grain of arsenic, is unable to demonstrate its presence. We cannot call it into separate existence, as we can oxygen and nitrogen; neither can we collect it, as we do imponderable and invisible electricity; or deposit it as we can the equally imperceptible ozone. It does

1 Chevers, Indian Annals Med. Science, vol. xii.

2 Martin, On Tropical Climates.

3 Burnes, Bombay Government Records, No. V., New Series.

not manifest its presence by an aroma like the violet and rose, or by a disgusting odour like sulphuretted hydrogen; yet, as we are certain of the existence of the poison producing typhus fever; of the agent causing small-pox, plague, scarlet fever, prison, camp, gaol, ship, or hospital fever, neither of which are we able to demonstrate, so we are equally sure that, as these latter poisons will arise under certain conditions, in the same manner, under other circumstances, marsh miasm or malaria will undoubtedly be formed. And not only do we know this, but we are also morally certain that the imponderable, invisible poison malaria may be wafted by the prevailing winds over the surface of a whole district, until, becoming attenuated by distance and lessened and thereby weakened by contact with various obstacles, it ceases to be sufficiently powerful to induce disease. In the same way that the invisible scent of the new-mown hay, or the peculiar odour of the land, is carried by the breeze and perceived miles out at sea; in like manner does this malaria travel *unperceived* miles away from the seat of its formation.

Hence we are enabled to understand the occasional baneful effects of the land wind; the noxiousness of the "Samiel" of Arabia and the Persian Gulf;[1] the effects of the chilling N.E. winds of Calcutta;[2] the injuriousness of the siroccos of the Mediterranean;[3] the fever laden blasts from the Pontine marshes;[4] and the N. E. winds from the Runn of Kutch; all of which charged with mephitic vapours bring discomfort with them, and too often leave diseases in their track.

I have just mentioned that our senses are unable to perceive the presence of malaria; but I think it will be allowed that there is a peculiar and sickly odour arising from marshy ground more or less apparent, according to the nature and extent of the drying-up surface. Without venturing to assert that this is the odour of marsh malaria, I may state that I should be exceedingly careful not to pitch my tent, or remain in any

[1] Remarks on the Climate of the Persian Gulf, &c., by the Author Brit. Med. Surg. Jour., Nov. 1856.

[2] Martin, On Tropical Climates.

[3] Jackson, The Travellers' Remembrancer.

[4] Ranken, Trans. Cal. Med. and Phys. Soc., No. 3.

locality, where this peculiar scent could be perceived. I have noticed this smell very many times when out snipe shooting, and have known it recognized by others after their attention was directed to it, and I can also assert that it is always more perceptible in the early morn and eventide than during the hours of sun-light. The question then naturally arises, how far can malaria extend ? Much must depend on the quantity generated at the starting point ; on the force of the winds ; and on the obstacles it may meet with in its progress. That trees have the power of staying its advance is fully recognized, and has frequently been turned to practical utility in India ; [1] and it is also very probable that hills, mountains, or, in fact, any natural or artificial obstruction, will either destroy it by contact, or, at least, turn it aside from its direct course. Hence, as a rule, the elevated regions of tropical climates are more free from malaria than their sides, or the plains from which the hills arise ; although, indeed, it is possible, as Dr. Fergusson [2] demonstrated, that the poison may be blown *over* an eminence and deposited on the other side.

The same authority observes that the inhabitants of ground-floors are uniformly affected, in greater proportion, with malarious disease, than those who sleep in upper-stories ; for the latter apartments are less liable to the entrance of malaria rolling on the surface of the ground than others situated lower down, the miasm, as it rises in the atmosphere, necessarily becoming more diluted and diffused as it ascends.

From a reference to the prevailing winds of Kutch, it will be seen that, during the whole year, south or south-westerly winds prevail for about ten months.

This renders Kutch as healthy as it is ; if the wind blew for the same number of months in the opposite direction *from* the Runn instead of *to* the Runn, the country would be still more sickly, and, as I believe, almost uninhabitable ; for it would then be the rule, and not the exception, for the province to be overflowed by the mephitic exhalations of the great salt marsh.

[1] Balfour, Madras Journal of Science, No. 36.

[2] Fergusson, Nature and History of the Marsh Poison.

As the winds blow so unusually from Kutch across the Runn it would naturally be supposed that the countries on the other side of the morass must be extremely unhealthy. This, I believe is the case in Parkur, and the south-west of Gujarat; but directly north is the Thur or Desert, in passing over which the miasmata would probably become destroyed, or diluted to such an extent as would render it comparatively innoccuous, before it could reach inhabited districts situated far away.

Proceeding in the review of the province, from the circumference to the centre, the next thing which demands notice from the medical topographist, is the geological nature of the country. This has been so well described, and fully discussed, by Captain Grant,[1] that it will not be necessary to do more than glance at those geological characteristics which are known, or presumed to exert an influence on health and disease. The state of Kutch, in its general aspect, may be described as a truly mountainous country, abounding in passes and gorges, and with eminences so diversified and broken up, that it is difficult to describe them in anything like regular order. These mountains are of all shapes—pinnacled, table-shaped, and conical; composed chiefly of volcanic and trappean rock, and sandstone. So late as 1819 an earthquake occurred which changed the face of the country in many parts; and indeed a few days back (October 10th, 1860), a slight shock was felt in the city and cantonment of Bhooj. The chief mountain ranges now evident are three in number—one the most northern, bordering the Runn; the Charwar, running through the centre of the province from east to west, and passing about two miles to the latter direction from Bhooj; thirdly, a smaller range, stretching in the opposite directions, and passing through the centre of the Charwar hills. In addition to these, there are numerous isolated hills in the northern portion of the province; but the southern part is flat, and covered by a rich alluvial soil, which becomes gradually more sandy towards the centre of the country. Neither of the mountain ranges form a protection to the cantonment of Bhooj from the N. E. winds from the Runn.

[1] Grant, On the Geology of Kutch, in Geological Papers on Western India; edited by H. J. Carter, F. R. S.

The centre or Charwar range of hills consists chiefly of a series of strata of limestone, slate, and slaty limestone, capped, as is the case with the hill of "Bhoojeah," by a soft red sandstone; while some of the smaller hills are composed of very ferruginous sandstone, and ironstone. The southern range is formed of much the same material; but all over the country, and particularly in the northern hills, rocks of igneous origin are easily recognizable. It would, in fact, be "difficult to name a region presenting clearer, or more numerous evidences of the disturbing power of igneous agents;" not only from the crater-like form of some of the hills, but also from the prevalence of plutonic rocks on every side; and from the abruptness of the precipices in one direction, and their gentle declivities on the other, it is very certain that the whole appearance of the country must, at some remote period, have presented a very different aspect to what it does at the present time. Moreover, by a reference to Captain Grant's Appendix, it will be seen that Kutch is particularly rich in fossils, of which the varieties comprised in the division Mollusca form no inconsiderable quantity. These, with other descriptions chiefly belonging to the Conchifera, are found not only on the borders of the Runn, but in other parts of the province.

Coal has been found in various parts of Kutch—in the banks of a nullah some six miles from Bhooj, and in the neighbourhood of Seesagud.

Iron also has been frequently smelted in the province; but the latter and the coal are not of that quality which would reward the speculator in a mercantile sense. Alum, however, is found in greater perfection, and the mines in the village of Mhurr have long been celebrated for their yield of this article. Saltpetre is also manufactured in the province.

Sir R. Martin states that he noticed, when passing through Orissa, that the entire soil was ferruginous; the same author gives the quality of the soil of the west coast of Africa, from reports obtained through Sir Charles Trevelyan, which is also ferruginous. Hongkong, Arracan, some portions of the southern states of America, and other localities are instanced as having the same description of soil, in all of which fever, of the inter-

mittent or remittent type, is the prevalent disease. To these localities may be added Kutch, where the prevalence of ferruginous sandstone, and malarious disease, is beyond doubt, and thus affording another example of a coincidence which experience shows is so frequently the case.

The present state of our knowledge does not permit us to state with certainty more than the fact of the coincidence just noticed. What the peculiar malaria may be which appears to be emitted from ferruginous rocks we are totally unable to surmise; but whether it be identical, or, as would *prima facie* appear different, to the exhalations arriving from marshes and undrained ground, we are morally certain that the same results, as regards human health and disease, occur both to those residing in the neighbourhood of swamps and to others located on a ferruginous surface, in the forms of remittent and intermittent fevers.

From what has been stated regarding the geological nature of Kutch, it will readily be imagined that the water must be impregnated, more or less, with saline matter; and such, indeed, is the case—about one half of the wells, or "weeras," being brackish, and holding in solution a large amount of muriate and carbonate of lime. Perhaps we may correctly refer the numerous cases of *calculus vesicæ* which are to be found throughout the whole country, both amongst children and adults (the stones in most instances being of the mulberry or oxalate of lime variety), to the constant use of this calcareous water.

Of mineral waters, as chalybeate, sulphurous, acidulous and of hot springs, I believe there are none throughout the whole province; but all the water in the neighbourhood of Bhooj, when tested by acetate of lead, nitrate of silver, and oxalate of ammonia, give abundant white precipitates, which, being respectively dissolved by nitric acid, not soluble in nitric acid, and easily destroyed by the same reagent, thus prove the presence of the carbonate and muriate of lime as before stated.

Rivers.—There are no constant streams. The river-courses are merely channels which convey the periodical floods to the

sea and the Runn, and contain, during the hot and dry season, only detached pools. The beds of these nullahs are either sandy or rocky, and in the neighbourhood and north of Bhooj very high and precipitous.

Cultivation.—According to Captain Raikes [1] the surface of the country may be divided thus—one-quarter of light sandy soil ; one and a half quarter of tolerably good arable land ; a half quarter of very good soil ; and one-quarter of hills. Of the arable land, about-one quarter is irrigated. The common grains produced are bajree, mut, gowar, jowaree, mong, and wheat, and there is also some cotton cultivation. The other parts of the country are overgrown with jungle grass ; the hills especially with the common milk bush.

Medicinal Plants.—Castor Oil ; Datura Stramonium Datura Alba ; Cucurbita pepo or Khonda ; and the Neem or Azadaracta indica, famed for its anthelmintic properties.

Having now glanced at what may be designated as the principal medical characteristics of the country, I proceed to describe the situation of the city, and military cantonment of Bhooj. The latter town is located in the centre of a valley, or rather slope, having mountains situated to the south, east, and west, but open towards the Runn on the north ; from which it is distant ten miles. Latitude 23° 15′ ; Longitude 69° 45′. It is the capital of the Province of Kutch, and sometimes called by the natives "Booje Booje." It is a well-built walled town, covering about two square miles, and containing a population of about 20,000 inhabitants, chiefly Hindoos. The houses are firmly structured, and built like those of Persian towns with a central courtyard. South-west and north of the city walls are two large tanks, partly artificial and partly natural, which, during the rainy season, become flooded to such an extent that the water from the southerly one runs over the whole tract intervening between the city and the Political Residency, reaching as far as the garden enclosure of the latter, a distance of at least three quarters of a mile. Direct west of the city, and adjoining the walls, is a large Mahomedan burial ground, situated on a slight rise of the surface, which indeed prevents the junction of

[1] Bombay Government Records, No. V., New Series.

the two tanks referred to. Still further west, is a low tract of marshy ground, formerly used as a racecourse; and bounding this again, are the hills or mountains mentioned above.

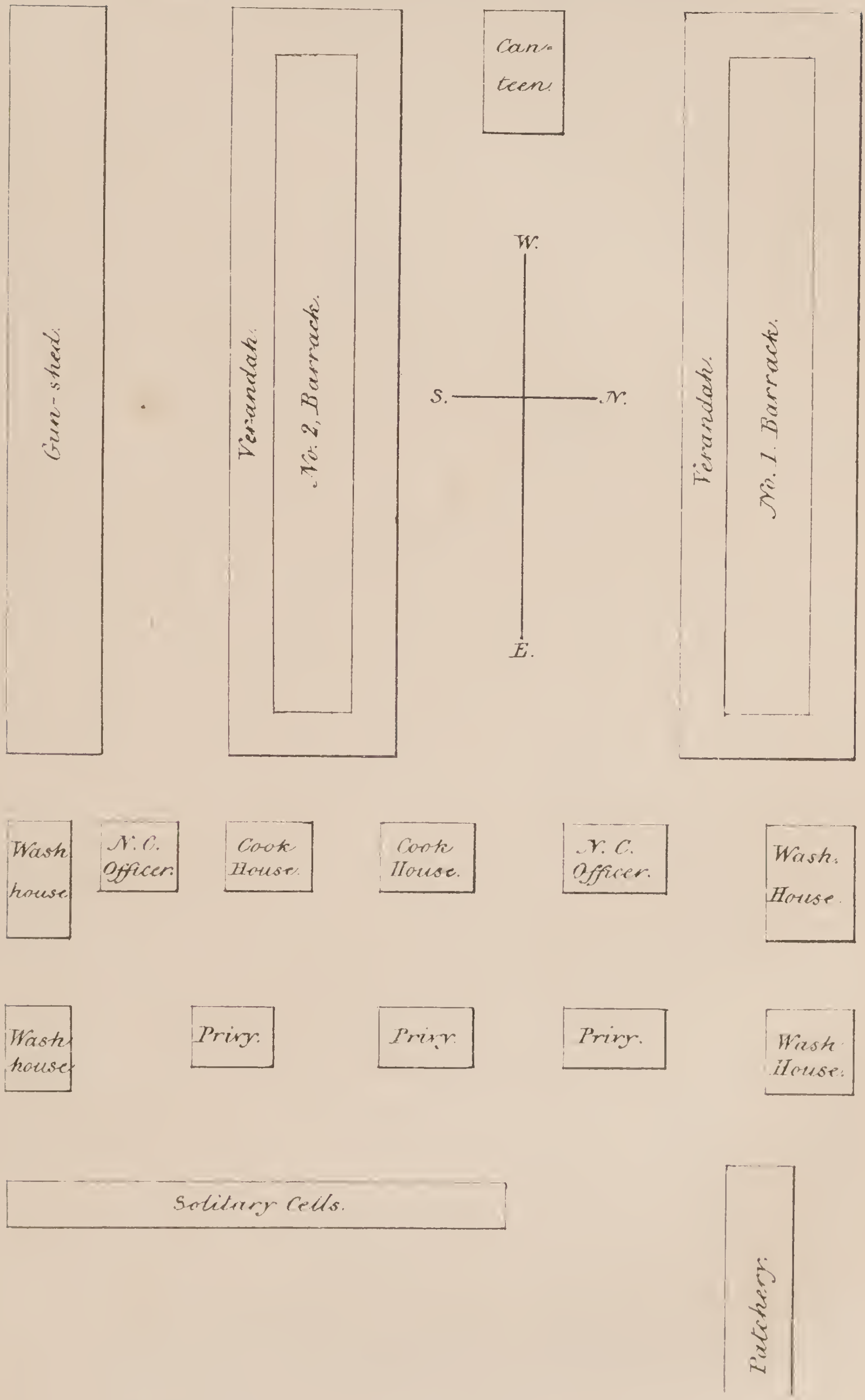
Directly south of the city, distant about half a mile, is the Residency of the Political Agent in Kutch; a "pukka" built bungalow, with up-stair rooms; in the hot season, and rains, a delightful residence; but for a short period after the latter, scarcely so desirable, exposed as it must be to the exhalations and miasm arising from the evaporation of the water which overflows from the tank.

From the city and the residency the land gradually slopes upwards, towards the hill fort of Bhooj called Bhoojeah; at the foot of which eminence the military cantonment is situated, distant from the city and Residency about one mile and a quarter, and lying in a line exactly east of those places. The hill, on which the fort is placed, is a long isolated formation, about five hundred feet high, composed chiefly of sand-stone, and consisting of two principal portions, one running almost due north and south, and the other from west to east. It is nearly covered with the common milk bush or thur, and presents a frowning and barren appearance. The chief road of the cantonment passes almost due north and south, along the foot of the spur of the hill pointing in those directions; while another road, proceeding from the southern extremity of the former, stretches almost at right angles, and therefore due east, along the sloping ground to the Residency, there joining the metalled road leading to the sea-port town of Mandavee.

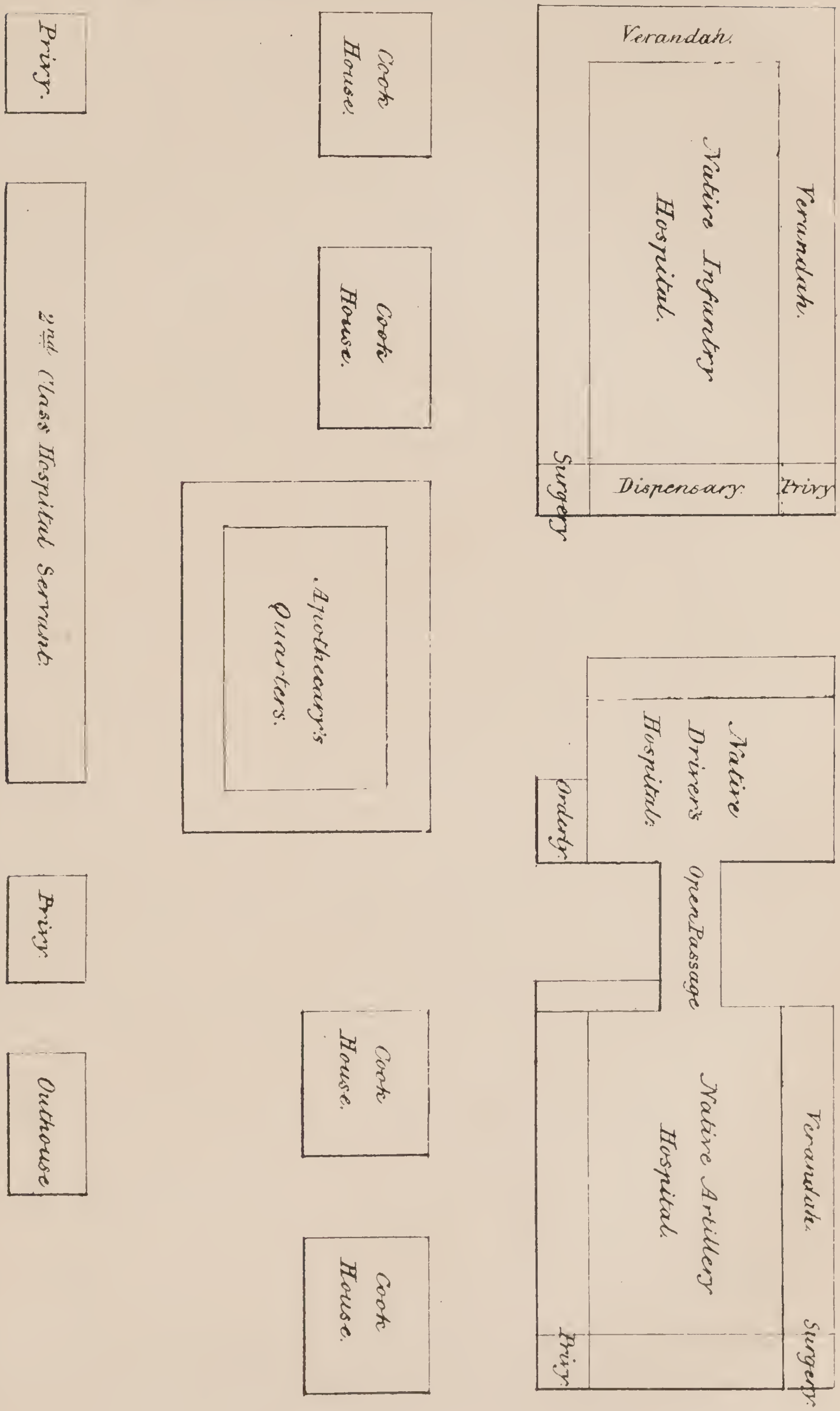
The officers' bungalows are situated in two rows, along either side of the first road mentioned, but are poorly-built edifices, generally level with the surface of the ground, and with two or three exceptions deficient of upper rooms.

At the angle formed by the two parts of the hill, and therefore at the south-west extremity, are the barracks, formerly occupied by European Artillery, but now used by the 3rd Company 4th Battalion Golundauze. More towards the south, and therefore farther from the hill, and nearly on a level with the first line of officers' bungalows, are the hospitals, two in number, and in their front is a slightly rocky and rising ground, beneath which

PLAN OF THE BARRACKS AND OUTHOUSES AT BHOOJ.



PLAN OF THE HOSPITALS AND OUTHOUSES.



are the lines of the Kutch Levy. In front of these lines is the parade ground, which occupies the space between the latter and the residency, and Mandavee road. On the other, or north side of the road, leading to the Residency from the camp, is the station garden, and the walled enclosures of the European and Portuguese burial grounds. The whole of the ground in cantonment is sandy, excepting where the red sandstone appears on the surface.

Barracks.—These buildings, and their out-houses, may be described collectively as forming an oblong square; the sides of the barracks themselves facing north and south, while the extremities are therefore east and west. They enclose a space of about 46 yards long by 40 broad. East of the barracks are situated the cookrooms and serjeants' quarters, while immediately behind these are the necessaries, and again in their rear the solitary cells. The wash-houses are detached buildings on either side of the non-commissioned officers' quarters. The barrack-rooms consist of one long apartment, measuring about thirty-two yards by eight, and surrounded by a verandah five feet broad. The material of which they are constructed is the red sandstone of the country, and the roof is composed of tiles, with two wooden ventilators on the summit, which, however are ill adapted for the desired purpose, consisting as they do of little more than holes in the roof covered by a raised wood-work and allowing, as they must do, the passage of wet through the apertures intended for ventilation between their sides and the upper extremities of the apertures in the roof.

Showing the number of Men the Barracks are calculated to accommodate allowing 1000 *cubic feet and* 64 *square feet per Man.*

Barracks.	Length.	Breadth.	Height.	Cubic contents.	Superficial space per Man.	No. of persons accommodated.	Aspect.
	ft.	ft.	ft.	ft.			
No. 1.	96	22	16	33,792	64	33	South, but shut in.
No. 2.	96	22	16	33,792	64	33	North.

The first fault apparent in the construction of these barracks is the want of a double roof, which, although collectively may be thinner than a single covering, will, from the stratum of air between the inner and outer covers being a non-conducting medium, prove cooler for those who reside beneath. Although the inner roof may be simply composed of mats or canvas, the air passing, horizontally between them through apertures for that purpose will, as Mr. Jeffreys observes, be an ever watchful corrector of heat.

The material of which the walls are built being the sandstone available in the country, is perhaps the best, and certainly was the cheapest obtainable. The massive walls, however, absorb during the day, and radiate during night, a large amount of caloric, and in any future erection, it would appear advisable, that strength only should be considered, the idea that thick and solid walls render interiors cool, being both theoretically and practically erroneous.

I cannot but think, thin stone masonry with iron supports, both for the walls and roof, to be the best material for the construction of public buildings in India. The massive timbers now requisite for the roof, besides being expensive, are sooner or later attacked by white ants, and hence the whole fabric is rendered insecure; and although there are objections to the use of iron, which becomes extremely hot in the warm season; still this defect could be materially obviated, by having the iron supports made hollow, with apertures at the extremities, and by incasing them in chunam, white-wash, or other non-conducting matter. The suggestion of Mr. Jeffreys with regard to upper-roomed barracks is very important; he recommends the sub-divisions of the ground-floor by narrow wall of unburnt brick. "These serve the purpose of girders, and as their distances may be small, where the ground-floor is employed only as domestic offices, or compartments for stores, the joists overlying them may be of very moderate scantling."

The barracks, although elevated on a platform or "chabutra," are not sufficiently removed from the surface of the ground. The experience of all ages concurs in the fact, that human habitations are healthy in comparison with their height from the

surface of the earth: numerous instances could be adduced where lower rooms have proved much more fatal to their inhabitants than the apartments situated immediately above. Examples of this are found in the works of John Hunter, William Fergusson, Sir Gilbert Blane, and in the Report on the Sickness and Mortality of the Troops in the West Indies, as quoted by Dr. Chevers.[1]

It is admitted that miasm is more powerful, or at least is capable of exerting a greater influence over the human system during the hours of sleep or night: some authorities even declaring their belief, that the sunlight destroys its power. Hence the desirability that all barracks in India should be constructed with upper sleeping apartments, the lower being used as reading, dining, and sitting-rooms.

Were I requested to state my opinion as to the elevation of barracks, I would recommend that the basement should be composed of arches through which the wind might freely pass. The arches should rise at least five and a half feet from the ground, and support both lower and upper apartments; the whole of course being surrounded by spacious verandahs. The system of building houses and barracks on raised platforms, so common in India, must be but one step less injurious than erecting them on the surface of the ground, as in too very many instances the "chabutra" is formed of rubbish and débris of all descriptions, which was the case lat ly with the barracks newly fitted up at Lucknow for a Queen's Regiment, where the elements of disease were concealed beneath the chunam surface to such an extent as to produce a large amount of sickness, thereby rendering inquiry, investigation, and removal of the nuisance imperative.

For much the same reason, store-houses should never be permitted to exist beneath barracks, becoming, as they can hardly fail to do, receptacles of damp and vitiated air which of course finds its way to the apartments above. Arches also must be kept clean and free from impurities, so as to admit thorough perflation.

[1] Ind. Annals Med. Science, Vol. xii.

Of course there are some difficulties to be overcome in the construction of two or more storied barracks, chiefly relative to urinary and washing conveniences, but the former should always be placed *both* on a level with the sleeping rooms and below, so that the occupants may use them night or day without unnecessary exposure. The entire separation from the body of the building of the latrines and lavatories, cannot but lead to undue exposure; and the use of any description of pipe or drain, is liable to lead to deposit, choking, and unhealthy exhalations; hence trapped portable pans should be supplied, and a sufficient number of sweepers entertained, to carry away the 'excretæ' at regular and frequent intervals.

Barracks, however, of more than two stories are not to be recommended, as those sleeping below must produce a certain amount of vitiated atmosphere, which will, to some extent, affect the denizens above, particularly during the colder or rainy weather, when it becomes necessary to close the windows of the building.

The walls of the barracks are whitewashed; whereas a glazed surface, not glaringly light, but of some slightly subdued tint, as light green, is less liable to attract and lodge organic impurities, and also more grateful to the eye than the present appearance.

The floors are of cowdung, always require renewing, and absorbing moisture during the wet season. Moreover, the periodical application of this dirt, as layer upon layer is smeared on, not only causes dampness for the time being, but adds to the matter, which cannot but be gradually decaying, and therefore constantly emitting baneful and poisonous malaria. The best flooring is that composed of small glazed tiles which may be thoroughly washed and as thoroughly dried, when held together by a good chunam cement; and their slipperiness may be obviated by the very smallest sprinkling of sand.

But whatever defects there may be in the construction of the barracks, their situation is open to still more serious objections. The first principles of barrack or hospital building, is the selection of the highest, clearest, and driest spot in the cantonment, and that best exposed to the prevailing currents

of air; none of which have been applied in fixing the site of these buildings. They are certainly high, but the hill of "Bhoojeah" rises higher and overhangs them; while within a stone's throw of their northern windows and of their eastern extremity, the milk bush and the cactus grow in all their wild luxuriance. Their locality, owing to the slope, is assuredly dry, but instead of facing the prevailing south or south-westerly breezes, which blow ten months in the year, they have an aspect due north and south; and being so close to the sandstone rock, they are rendered almost insufferably hot, both night and day, by the radiation of heat which the former constantly absorbs. Moreover, as may be seen by the ground plan annexed, the breeze is completely shut out from No. 2 Barrack, by the gun-shed, and still more entirely intercepted in its passage to No. 1 by both the gun-shed and the other barrack, excepting indeed at the extreme west.

My predecessor at this station, Dr. Hewlett, who had charge of the Europeans then residing in the barracks, states that the men complained very much of the excessive heat during the day, and found themselves daily losing flesh from the continued perspiration to which they were subjected, in consequence of the unfortunate position of their habitations.

The same officer also stated, that in consequence of the vicinity of the cook-houses and necessaries, the men complained they were troubled with innumerable flies, while he reports the wash-houses and solitary cells to be deficient in number, and inadequate as to area.

All things considered, I am constrained to form the opinion that these barracks are unfitted for the residence of European soldiers; not however so much from the faults inherent in their construction, as from their unfortunate situation and locality, being as they are close to a heat-absorbing sandstone rock; pointing the opposite direction from which the wind blows during ten months in the year; and being still more shut out from the breeze the one by the other, and the other by the gun-shed. If the latter were removed, it would be an immense advantage.

It is difficult to imagine what military reason could exist for placing these buildings in their peculiar position; and it is equally impossible to opine what hygeinic or sanitary recommendations led to this spot being fixed upon for their location, particularly as half a mile or more away to the south-west, there is a dry elevated spot, which, as far as can be the case in the Bhooj cantonment, presents all the desiratives required for a barrack site.

Showing the Number of Patients the Hospitals are calculated to accommodate, allowing 1000 *cubic feet and* 64 *superficial feet per man.*

Hospitals.	Length.	Breadth.	Height.	Cubic contents.	Superficial space per Man.	No. of Patients.	Aspect.
	ft.	ft.	ft.	ft.			
Artillery....	506	34	12	20,400	80	20	West.
Native ...	96	22	15	31,680	64	30	West.

Now the same faults are apparent in the construction of these hospitals, as have been briefly adverted to when speaking of the barracks; viz. the want of a double roof; of a glazed, neutral tinted composition for the walls; of a proper flooring; of an arched basis for the superstructure; and of upper rooms. These arrangements are not however, for obvious reasons, of so much importance for the hospitals intended for native troops as for those to be used by European sick, to which the remarks on barrack and hospital accommodation and construction are more strictly applicable.

The verandahs of the hospital are furnished with matting stretched on frames, thus serving the purpose of a screen, excluding both light, air, and sand; but they are open to many objections. If closed, the interior is too dark for the medical officer to carry on his duty, and if they are opened altogether, they are of no use whatever. Moreover, offering so solid an obstruction to the high winds when closed, they do not allow thorough perflation; and are also being constantly blown down,

and requiring repair. A great improvement would be the substitution of checks instead of these verandah shades, and the addition of Venetian blinds to the inner window frames. By means of the latter, both the entrance of air and light could be regulated at will, while at those periods of the day, when it may be necessary to ventilate the whole building, the chicks would not interfere with the free entrance of the wind. Checks are not expensive, and although the wooden Venetians might form a large item of expenditure at first, still after their application, they would not require the repeated repairs which the mattings must have.

Native Lines.—The Lines, a portion of which are at present occupied by the Kutch Levy, are, as already stated, situated on the south of the road, leading from the cantonment to the Political Residency, and, having been originally intended for more than one Regiment, occupy a greater space than is at present required. Many of the houses are in a delapidated, and ruined condition; roofs fallen in, and the four standing walls filled with rubbish and débris of all description; a state not conducive to a satisfactory and healthy cantonment. One of the great desiratives for the production of the latter is the removal of all ruined and decaying buildings, which cannot fail in becoming receptacles for the refuse formerly referred to, and are also the abodes and graves of numbers of wild animals and of myriads of the insect tribe, whose decaying emanations cannot but prove in some degree inimical to human health.

The houses being erected in rows with their gable ends pointing towards the west, are not therefore thoroughly exposed to the prevailing breeze. Were they placed diagonally to their present position, and still better in èchèlon, the wind would not only sweep the streets, but also pass through the majority of the buildings from front to back.

I do not think, all things considered, that there is a better site for native lines in the whole cantonment, than the present position; and I should not feel disposed to recommend their removal for the following reasons:—They are at present placed on a sloping ground, with a nullah in front, and therefore, susceptible of the highest artificial drainage; while at the same

time the nullah is so far removed, as to preclude the fear of deleterious emanations from it affecting the men to any great extent. There are also many trees about the old houses which have been the growth of years, and, without being sufficiently numerous to intercept the free circulation of air, afford grateful shade and shelter to the sepoys. Wells also are excavated, and yield tolerable water, which might not be procured of so good a quality in another position.

There is, however, one locality which has been already noticed when on the subject of barracks, where the lines would be certainly in a better position as regards sanitary requisites. This is on a raised ground directly in front of the hospitals; but I cannot recommend their removal there, as, in addition to the fact of there being no trees and the uncertainty of finding good water, they would in some degree keep the breeze from passing freely into the hospitals, or at all events oblige it to reach those buildings, laden with whatever effluvia it might come in contact with during its previous passage over the lines. Moreover if the lines were removed to this position, they would be away from the centre of camp, and their southern extremity would almost reach the limits of the cantonment; and thus facility would be afforded for the men to wander into the jungle at will.

Of course the present site requires much labour, in the way of drainage, levelling hollows, and removing decaying and ruinous buildings; but a new site would require very much more, in the erection of buildings and sinking of wells, &c., while trees could only be the growth of years. Altogether the advantages of removal do not counterbalance the disadvantages which may be thought to arise by retaining the native lines in their present position. It has been stated that the foundations of the houses soon give way; but as they are placed on a red sandstone rock covered by a layer of sand, I have no doubt that deeper foundations and good drainage would effectually obviate this objection.

Meteorological Observations. TABLE I.—*Showing the average range for ten years, in the Cantonment of Bhooj.*

Years.	1848	1849	1850	1851	1852	1853	1857	1858	1859	1860
Average range of Thermometer. ..	° 84·16	° 96·63	° 94·16	° 94·66	° 94·75	° 94·25	° 93·80	° 94·15	° 95·10	

The first four years are taken from Captain Raikes' memoir on Kutch; the last four are calculated from the meteorological records now existing. The latter also show that, throughout the whole year, sunrise is the coldest part of the twenty-four hours, the mercury gradually elevating until four P. M.: during the next interval between the observations, or from that time till sunset the difference is not so marked, although indeed the evenings almost invariably *feel* cool in consequence of the south or south-west breeze from the coasts. December, January, and February are the coldest months in the year, and May and June the hottest, and there appears to be very little variation in the average temperature of the different twelve months.

The greatest range of temperature takes place in January, February, November, and December; when it amounts to 20°. The least range is in July and August, when it is as low as 6°.

TABLE II.—*Showing the range of Temperature between the Maximum and Minimum for* 1857-58-59.

Months.	No.	Months.	No.	Months.	No.
1857.		1858.		1859.	
January	20°	January	18°	January	18°
February	20	February	18	February	18
March	19	March	18	March	17
April	17	April	17	April..........	17
May	16	May	16	May	17
June	13	June..........	13	June..	13
July	9	July	7	July	6
August	6	August	7	August	7
September	8	September	9	September	9
October	15	October	16	October	12
November	19	November	19	November	18
December	19	December......	20	December	19

There is no register of the wet bulb thermometer for any year excepting 1857, so that it is impossible to institute any comparison; but from the daily record existing for that year, it would appear that the maximum depression occurs in June, and the minimum in December. The monsoon rains of 1857, amounting to thirteen inches and eighty-six cents (which is about the average amount), seem hardly to affect the rate of evaporation so much as the fogs and damp which prevail during the colder months. During November, December, and January, there is always a copious deposition of dew at night, and yet this seems scarcely to disturb the dryness of the climate, which, considering the peculiar insolated position of Kutch, is somewhat remarkable. It is however stated for a fact, that gunpowder keeps better and remains dry longer in the hill fort of Bhoojeah (already described as overhanging the cantonment), than at many other stations of the Presidency.

TABLE III.—*Showing the mean Temperature of each month, during the years* 1857-58-59 *and* 1860.

Months.	Sunrise.		10 A.M.		4 P.M.		Sunset.		10 P.M.	
	Sums.	Means.	Sums.	Means.	Sums.	Means.	Sums.	Means.	Sums.	Means.
January......1857	..	..	..	..	..	..	..	..	..	..
,, ...1858	1757	56·7	2117	68·3	2302	74·3	2164	69·8	1921	60·7
,, ...1859	1851	59·70	2078	67·03	2303	74·2	2172	70·0	1995	64·3
,, ...1860	1851	59·70	2078	67·03	2303	74·2	2172	70·0	1995	64·3
February 1857	1827	65·25	2151	76·82	2379	84·96	2231	79·67	2030	72·50
,, ...1858	1751	62·5	2169	77·4	2240	80·0	2112	75·4	1919	68·5
,, ...1859	1827	65·24	2151	76·80	2379	84·96	2231	79·60	2021	72·50
,, ...1860	1910	65·86	2157	74·3	2342	80·7	2206	76·07	2030	70·0
March 1857	2220	71·93	2679	86·41	2865	92·41	2683	86·54	2478	79·93
,, ...1858	2201	71·0	2679	86·41	2787	89·86	2684	86·33	2444	77·9
,, ...1859	2180	70·3	2578	83·1	2778	89·6	2873	83·0	2350	75·8
,, ...1860	2201	71·0	2531	81·64	2788	89·87	2591	83·58	2344	75·6

Months.	Sunrise.		10 A.M.		4 P.M.		Sunset.		10 P.M.	
	Sums.	Means.	Sums.	Means.	Sums.	Means.	Sums.	Means.	Sums.	Means.
April 1857	2280	76·0	2591	86·6	2801	93·36	2718	90·6	2431	81·33
,, ...1858	2313	77·1	2778	92·6	2957	98·5	2714	90·4	2505	83·5
,, ...1859	2213	75·1	2598	86·6	2770	91·5	2617	85·3	2331	70·0
,, ...1860	2255	75·1	2642	88·0	2780	92·6	2566	85·5	2372	70·0
May 1857	2515	81·12	2762	89·09	3008	97·03	2753	88·80	2609	84·16
,, ...1858	2550	82·2	2947	95·1	3063	98·8	2998	90·2	2654	85·6
,, ...1859	..	..	..	..	..	..	..	..	..	..
,, ...1860	2464	79·4	2788	89·9	2888	93·1	2653	85·5	2505	80·8
June 1857	2492	83·06	2699	89·96	2890	96·33	2665	88·83	2567	85·56
,, ...1858	2480	82·6	2771	92·3	2874	95·8	2648	88·2	2864	85·4
,, ...1859	2504	83·4	2696	89·80	2724	90·80	2648	88·0	2538	84·60
,, ...1860	2470	82·3	2858	95·2	2771	92·3	8587	86·2	2494	83·1
July 1857	2535	81·77	2744	88·51	2796	90·19	2649	85·45	2582	83·29
,, ...1858	2520	81·3	2728	88·0	2720	87·7	2514	81·1	2553	82·3
,, ...1859	2541	81·97	2047	85·39	2589	86·74	2628	84·77	2610	84·19
,, ...1860	2510	80·3	2750	87·4	2796	90·19	..	..	..	..
August 1857	2452	79·09	2590	83·54	2604	84·0	2520	81·29	2463	79·48
,, ...1858	2535	81·77	2728	88·0	2589	86·74	2628	84·77	2610	84·19
,, ...1859	2398	77·35	2484	83·35	2633	84·9	2529	81·58	2426	78·26
,, ...1860	..	..	..	..	..	..	..	..	..	..
September ..1857	2316	77·02	2503	83·43	2569	85·63	2453	81·76	2370	79·0
,, ..1858	..	..	..	..						
,, ..1859	2301	76·7	2494	83·13	2584	86·13	2460	80·0	2339	77·96
,, ..1860	..	..	..	..	..	..	..	..	..	..
October 1857	2308	74·4	2660	85·8	2775	89·5	2635	85·0	2451	79·0
,, ...1858	..	..	..	..	..	..	..	..	..	..
,, ...1859	2341	74·55	2618	84·45	2776	89·55	2532	83·29	2405	77·58
,, ...1860	..	..	..	..	..	..	..	..	..	..
November....1857	1954	65·1	2354	78·4	2525	84·1	2378	79·2	2133	71·1
,, ...1858	..	..	..	..	..	..	..	..	..	..
,, ...1859	2145	71·5	2404	80·13	2586	86·2	2456	81·86	2273	75·78
,, ...1860	..	..	..	..	..	..	..	..	..	..
December 1857	1857	59·9	2245	72·4	2431	78·4	2296	74·0	2061	66·5
,, ...1858	..	..	..	..	..	..	..	..	..	..
,, ...1859	1856	59·87	2104	67·87	2295	74·03	2182	70·38	1989	64·16
,, ...1860	..	..	..	..	..	..	..	..	..	..

Note.—This table is not complete, as some of the Meteorological tables are unaccountably missing.

Rainfall.—The monsoon is generally very moderate, the average fall being between twelve and thirteen inches, occasionally very heavy rains are experienced, as for instance in 1850 and 1851, when upwards of twenty-one inches fell, washing down innumerable houses, and destroying 20,000 head of cattle. Sometimes, however, the monsoon nearly fails, as was the case in 1819, and again in this present year 1860, in consequence of which the greatest distress is now prevalent.

TABLE IV.—*Showing the fall of Rain at Bhooj for the ten years as under.*

YEARS.	1848		1849		1850		1851		1852		1853		1857		1858		1859		1860	
MONTHS.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.
January	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
February	..	.	..	..	..	..	..	..	..	..	..	..	..	91	..	..	..	..	..	..
March	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..
April	..	..	..	..	..	70	..	..	..	..	..	..	.	..	.	..	..	..	..	..
May	..	..	..	2	..	..	1	84	..	..	..	..	..	..	..	..	..	..	..	..
June	..	..	3	14	..	..	.	..	..	..	1	14	..	88	..	15	..	47	..	23
July	..	..	1	86	11	11	17	4	4	45	4	22	..	58	5	99	4	24	..	23
August	..	..	1	97	..	38	2	19	12	53	..	23	4	71	..	36	2	56	..	58
September	..	10	1	80	..	..	..	..	2	34	..	58	6	78	..	13	2	..	..	33
October	..	..	..	..	9	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
November	..	..	..	..	..	20	..	35	..	..	..	4	..	..	..	..	..	..	..	..
December	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	..	10	8	79	21	60	21	51	19	32	5	21	13	86	6	63	9	27	1	17

It was noticed by Dr. Burnes, formerly Residency Surgeon at Bhooj, that those years when little rain fell, or when the monsoon failed, were most favourable to the health of Europeans, and he instances the facts that Kutch was very healthy in the years 1823 and 1824 when little rain fell, but the contrary to a melancholy degree in 1825, after a considerable monsoon.

That this is the case cannot well be doubted, when the formation of the surface of the country is considered, being a hard red sandstone rock, in many places cropping out on the surface,

and presenting numerous hollows and cavities, in which the water collects and remains, until removed by the process of evaporation. In these holes also are collections of dead leaves, and other débris, only requiring the addition of moisture to become transformed into subtle malarious poison. The water-courses and nullahs about Bhooj, as before observed, are mostly rocky and deep, and receptacles during the dry season for all kinds of dead vegetable matter, which the winds hurl into their yawning chasms.

The prevailing winds in Kutch are westerly. It blows between west and south during at least ten months in the year, and the other two months may be allowed for variable and easterly breezes. The latter and northerly are always unhealthy, and unpleasant to the feeling, and attended, if long continued, with more or less of epidemic disease, probably from their being loaded with mephitic vapours from the Runn. They are also said occasionally to bring flights of locusts with them, and the cold is of that peculiar searching character, which renders it more difficult to be borne by a sickly European than the chilling blasts of Caledonia, or the furious autumnal gales of the Atlantic.

TABLE V.—*Showing the Direction of the Wind each day, during the undermentioned four years* 1857-58-59-60.

Months.	N.	S.	E.	W.	N. E.	S.E.	N.W.	S.W.
January 1857	7	..	..	11	1	..	..	9
" 1858	17	..	..	7	5	..	1	..
" 1859	..	..	..	..	..	..	..	..
" 1860	19	1	7	1	..	..	..	3
February........1857	8	..	..	10	1	..	..	9
" 1858	4	..	5	5	8	..	..	6
" 1859	..	..	..	..	..	..	..	..
" 1860	18	1	1	9	..	..	..	..
March..........1857	3	..	2	6	1	..	..	19
" 1858	..	..	..	..	..	..	..	..
" 1859	..	..	..	..	..	..	..	31
" 1860	2	..	..	25	2	..	..	2
April 1857	..	..	..	..	..	..	..	30
" 1858	2	..	..	1	1	..	..	26
" 1859	..	..	..	..	..	..	..	..
" 1860	..	..	..	20	..	..	..	11
May 1857	..	..	..	..	..	..	..	31
" 1858	..	3	..	..	..	..	..	28
" 1859	..	..	..	..	..	..	..	..
" 1860	..	..	..	10	..	..	..	20
June 1857	..	18	1	..	2	..	..	9
" 1858	..	..	..	..	..	..	..	30
" 1859	..	..	..	..	..	..	..	30
" 1860	..	3	..	11	..	..	..	16
July 1857	..	10	2	..	..	..	..	19
" 1858	..	..	..	..	..	..	..	31
" 1859	..	..	..	1	2	1	..	27
" 1860	..	3	..	12	..	..	..	17
August 1857	..	2	..	1	3	..	5	20
" 1858	..	..	..	3	3	..	4	21
" 1859	1	..	..	4	..	..	..	26
" 1860	2	..	..	5	2	..	..	22
September 1857	..	..	..	5	..	..	..	25
" 1858	..	..	..	..	..	..	..	..
" 1859	..	..	1	7	..	..	..	22
" 1860	2	..	3	8	2	..	..	15
October 1857	4	..	10	10	5	..	..	2
" 1858	..	..	..	..	..	..	..	..
" 1859	..	..	..	1	2	..	14	14
" 1860	..	..	..	..	..	..	..	..
November 1857	3	..	7	1	15	..	..	4
" 1858	1	..	3	7	12	..	..	7
" 1859	13	..	8	5	4	..	..	..
" 1860	..	..	..	..	..	..	..	..
December 1857	6	..	8	..	12	..	..	5
" 1858	8	..	6	..	12	..	..	5
" 1859	26	..	1	2	2	..	..	..
" 1860	..	..	..	..	..	..	..	..

TABLE VI.—*Exhibiting the number of cases of Intermittent Fever —Quotidian, Tertian, and Quartan,—of Rheumatism, of Phlegmon, of Dracunculus, and of Remittent Fever, admitted during the corresponding Months of* 1858, 1859, *and* 1860.

Months.	Strength.	Feb. Intermit. Quot.	Feb. Intermit. Tert.	Feb. Intermit. Quart.	Rheumatism.	Phlegmon.	Dracunculus.	Feb. Remittens.
January 1858	304	3	1	2	1	2	2	..
,, ...1859	341	4	..	..	4	3	..	..
,, ...1860	340	1	..	..	..	..	..	..
February........1858	338	1	2	2	1	1	2	..
,, ...1859	477	1	..	..	3	2	..	..
,, ...1860	332	2	..	..	1	1	..	..
March 1858	332	8	..	1	3	8	1	..
,, ...1859	394	6	..	..	1	..	1	..
,, ...1860	..	2	..	..	..	1	..	..
April 1858	333	18	..	..	..	3	2	..
,, ...1859	..	5	..	..	3	4	3	..
,, ...1860	384	4	..	..	..	..	..	1
May............1858	304	4	..	..	3	1	2	..
,, ...1859	..	2	..	..	1	11	..	..
,, ...1860	394	7	..	..	4	6	1	..
June 1858	332	1	..	..	..	..	4	..
,, ...1859	394	5	1	..	2	1	1	..
,, ...1860	394	3	1	..	4	6	1	..
July 1858	330	2	..	..	..	..	3	..
,, ...1859	372	4	..	1	..	2	6	..
,, ...1860	384	5	..	..	1	1	10	..
August..........1858	286	5	1	..	..	3	2	..
,, ...1859	353	3	..	..	..	..	3	..
,, ...1860	384	12	..	..	2	2	2	..
September 1858	328	..	..	1	3	2	2	..
,, ...1859	322	13	1	1	..	..	..	1
,, ...1860	384	12	..	..	2	2	2	..
October 1858	335	7	1	..	..	3	1	..
,, ...1859	325	56	3	..	..	..	1	..
,, ...1860	..	..	..	..	..	..	..	..
November 1858	385	14	..	..	5	2	1	3
,, ...1859	324	20	2	..	..	1	..	..
,, ...1860	..	..	..	..	..	..	..	..
December 1858	477	8	..	..	3	2	1	..
,, ...1859	324	6	1	..	1	..	1	..
,, ...1860	..	..	..	..	..	..	..	..

From this table it is at once perceived that the most prevalent disease at Bhooj is one or other of the varieties of intermittent fever; and of the three types of this disease the quotidian is by far the most common. The experience indeed of all observers in India shows this to be universally the case. Morehead gives 86 per cent. of this type, Martin 70, Waring 70, and Macpherson 85; but according to Copland, Watson, and Elliotson, in colder climates, the tertian variety is, what these authorities designate, the primary type.

The Hospital records show only three deaths out of the whole number of cases of fever treated during the year under review; and of these fatal cases, two were complicated with bronchitis, and one with abdominal inflammation.

It would therefore appear that the fever of Bhooj must be of a mild type, and so certainly my limited experience leads me to suppose, and indeed Dr. Burnes, writing in 1857, states "the paroxysms are never severe, and the sulphate of quinine is a perfect check."

I cannot, however, agree with the assertion that the exhibition of the sulphate of quinine is a certain method of preventing the recurrence of the paroxysms. On the contrary, I have in very many instances known it fail in producing the slightest good result, either when administered in one large dose previously to the expected paroxysm, or in smaller doses frequently repeated during the intermission. I will, however, take this opportunity of stating, that my experience both here and elsewhere, leads me to prefer the repeated small doses of quinine, to the one large dose advocated by Drs. Mackinnon, Murchison, and others, on the grounds of increased efficacy, economy, and less demand of hospital attendance; the two latter reasons being, in my opinion, especially in cantonment or civil practice, worthy only of very secondary consideration.

Small doses of three or four grains appear from my observation to lessen the frequency of the pulse, while at the same time its power and healthy elasticity is increased, and nutrition is stimulated. This conclusion I am aware is different to that of M. Brequet, who considers quinine a stimulant in small doses. Frequently repeated, it may often prove so by cumulative action, as has occurred in my own person;

but at first I cannot view it as such, considering indeed that it produces its good effects by blunting the sensibility of the nervous system, rather than by adding to the *vis vitæ* by stimulation. In large doses there is no doubt of its being an active excitant, and afterwards that it produces a corresponding amount of depression; these facts forming other reasons against its employment in large doses.

The short period over which the Records of the Levy extend, renders it impossible to speak with any very great amount of authority as to the most unhealthy season of the year at Bhooj. It, however, seems indisputable, that the six months from August to January inclusive, are those in which the greatest amount of sickness occurs; while of the quarters, the autumnal one ending in November is most injurious. This, however, is nothing more than obtains in every part of India, malarious exhalations from obvious causes being more abundant at the latter season. On glancing over the list of number of cases admitted, the increase in October 1859 is apparent, for which perhaps a reason may be found in the prevalence of North-west winds during that month, which, although not blowing directly from the Runn, may certainly be considered more likely to induce disease than the south and south-westerly breezes which proceed straight from the ocean. The monsoon of 1859 was scarcely an average one, only 9 inches 67 cents of rain having fallen, and but 13 inches 2 cents measured in September and none in October. The rain then, and the local causes of disease, which it might affect, could not exert any very decided influence, so as to induce the increase of patients in the month of October, fifty-nine of whom as exhibited in Table IV., were suffering from one or other of the varieties of intermittent fever. Table III. also shows there was nothing extraordinary in the temperature of the month to account for the number treated. If, however, the table showing the direction of the winds is referred to, it will be seen that during the month in question, the winds had a greater northerly direction than during many other months, and this change occurring just at the period when the generation of miasmata would be most abundant on the Runn, cannot but lead to the inference that something deleterious to the human constitution, was

wafted by these breezes from the latter locality, where there can be no doubt such malaria existed in a concentrated state.

TABLE VII.—*Showing the number of Cases admitted during each month of the years under review.*

Months.	Strength.	No. of Cases of all description admitted during the several Months.	Treated to Strength.
January 1858	304	21	8·2
„ 1859	341	22	7·9
„ 1860	340	5	2·0
February 1858	334	23	9·2
„ 1859	477	14	3·7
„ 1860	335	7	2·3
March 1858	332	25	10·6
„ 1859	395	18	5·5
„ 1860	379	11	3·4
April 1858	333	30	11·1
„ 1859	320	22	10·3
„ 1860	384	11	3·6
May 1858	304	18	9·5
„ 1859	379	18	6·8
„ 1860	394	26	7·8
June 1858	332	11	4·8
„ 1859	394	16	6·3
„ 1860	394	26	8·3
July 1858	330	10	4·8
„ 1859	372	23	8·8
„ 1860	384	31	9·1
August 1858	286	19	8·0
„ 1859	353	10	5·3
„ 1860	314	34	14·3
September 1858	328	16	6·4
„ 1859	322	25	9·6
„ 1860	303	22	7·2
October 1858	331	17	7·2
„ 1859	326	67	25·3
„ 1860	....	....	....
November 1858	385	38	11·1
„ 1859	324	26	14·1
„ 1860	....	....	....
December 1858	477	22	8·5
„ 1859	324	12	5·2
„ 1860	....	....	....

It will be observed from Table IV. that Dracunculus is occasionally prevalent at Bhooj. This entozoon has been the subject of such patient investigation by Drs. Carter, Grierson, Forbes, Duncan, and others, that but little remains to be discovered regarding its habits, although, indeed, the mode in which it effects entrance into the human body must still be considered as "*sub judice*." It is worthy of remark, that Table IV. shows Dracunculus to be more prevalent during the months of July and August at Bhooj, than at any other period of the year; and this was not only the case with the Kutch Levy, but also with the horse-keepers of the 3rd Company 4th Battalion Artillery, who, however, used water from different and widely separated wells. It is a peculiar fact, that the Kutchee men of the Levy confidently denied that they could have contracted the disease from any of the water in the neighbourhood of Bhooj, but always stated they supposed they must have caught it when away from this locality; but as individuals are subject to it who have not been away, I conclude this idea originates from the love which the Kutchees proverbially entertain for their native place. On several occasions I made microscopical examination of the water and mud of the different wells; but was unable, with the small microscope I possess, to satisfy myself that the small worms described by Dr. Carter and Messrs. Duncan and Forbes existed.

Several cases have been admitted into the Kutch Levy Hospital, and returned as Rheumatism, in which the disease appeared to commence with a peculiar hardening of the skin of the heel and ball of the great toe, this being attended with rheumatic pains, occasionally very intense, affecting the foot and legs, and occasionally the other parts of the body. At first I was disposed to consider this as the disease, or at least a modification of the affection, described by Sir James McGregor and Sir George Ballingall as "burning in the feet;" but I found, if neglected, this hardened skin became reddened and inflamed, and soon degenerated into a foul sluggish ulcer, not unlike a scrofulous sore in appearance. In an advanced stage, there are a number of elevated tubercular-looking growths visible in the deepest part of the wound; and in a case which I have seen at the Bhooj Dispensary, the bones were affected, more or less softened, and filled with a tubercular-looking matter, and the

limb rendered so useless as to necessitate amputation. The form and shape of the foot in the cases I have seen was but little if at all altered; and I am therefore disposed to the opinion that it is not the same disease which has been described by Dr. Godfrey in the Lancet, and more latterly by Mr. Eyre of the Madras Service, in the Indian Annals of Medical Science. The best treatment is, in the first stage, nitrate of silver to the hardened skin, frequent bathing the feet in warm water, together with the usual remedies for rheumatism; the ulcerated state appears to benefit more from stimulating applications, and occasional scarifications with the knife, combined with perfect rest, than from any other method of treatment.

Beri-Beri.—I believe Beri-Beri is sometimes seen at Bhooj, but I have not found any notice of a case having been admitted into the Kutch Levy Hospital, and I merely mention the subject for the purpose of recording my objection to what I consider an erroneous impression which appears to exist, that Beri-Beri is only seen in the male subject. It is stated scarcely ever to attack boys under adult age; and a case occurring in a female, has not, as far as my recollection serves, been noticed by any author who has hitherto written on the disease. This may probably arise from the Military Surgeon's duties, especially in the tropics, being so frequently almost confined to the sterner sex; but a short time since I had a woman under my care, the wife of a sowar belonging to the Levy, who was afflicted with a disease to which I could not apply any other term than Beri-Beri. I have also seen one other instance of the affection in a Seedee female, occurring at Bassadore in the Persian Gulf, and hence I consider I am justified in stating the fact, that the female is, although perhaps very rarely, liable to this affection. The case I mention as being under my care at Bhooj, presented all the symptoms of well-marked Beri-Beri, and the woman was a spare, emaciated, and cachectic individual. She was somewhat relieved by appropriate remedies, but was eventually removed by her friends to her native village, where I heard she afterwards died.

Cholera is not a frequent epidemic in Kutch. At the present time, October 1860, it is very prevalent in the city of Bhooj, and has also appeared in the Military Cantonment.

ANNUAL REPORT ON JACOBABAD, FOR 1859-60.

BY ASSISTANT SURGEON J. LALOR, A.B., SIND HORSE.

Presented by the Principal Inspector General Medical Department.

In submitting the following annual report, I must beg particularly to notice that I have endeavoured to embrace all the natural and physical features of the country, and attendant phenomena, with the object of facilitating in future the comprehension of any views that reasoning or experiment may awaken.

The topography of Jacobabad has been so often noticed that it will be merely necessary for the purpose of this paper to premise that it is about five hundred feet above the level of the sea, is amply supplied with water, surrounded on every side by a desert, which subtends the West, North, and Eastern ranges of those bleak, barren, and dreary-looking hills so often described, and spreads itself out for five or six hundred miles towards the sea, into the vast plains of Kutchee and Sind. Thus situated, it will be more easily understood, how it must be affected by the severe influences to which it is subjected.

Hot Winds.—The wind, passing down from these bare and fiery rocks, is almost totally devoid of moisture, and gathering, as it comes over the arid plains, only portions of ascending currents of intensely heated air, produces sensations similar to the blasts of a furnace. From this direction, as far as I could observe, blows the so-called *Simoom,* irregular and unusual in its occurrence, but often fatal in its effects. Whether it be caused simply by local ascending currents, carrying up as they do quantities of sand and dust, and capable of producing constriction of the tissues and death by undue heat and dryness, or whether it bears along some noxious vapour or poisonous gases, must be a subject for further discussion. Its peculiar "lurid appearance" is, I think, no doubt, the result of the light particles of sand, and the absence of condensation,

which obscures the sun's rays in other atmospheric and electrical disturbances. No precise data seem to affix the rate at which it travels. In 1859, two men were struck down. The high wind that sometimes precedes a dust-storm and the storm itself passed over in the interval of the men absenting themselves and the finding of the bodies; but whether these circumstances had any connection with the deaths in question or not it is impossible to say. I myself have certainly felt, particularly in districts where sulphur, sulphates, and nitrates abound, the most choking and disagreeable sensations on the occurrence of even trifling dust-storms, and this in winter, when the sun's rays had comparatively little power to effect the weight, size, or molecular formation of matter. In 1858 I made a post-mortem examination of a man found dead on the parade ground. The wind had been blowing briskly in the morning from the N.W. and N., but nothing approaching a hurricane or storm. Death in this instance had been apparently by asphyxia, but no inference could be legitimately deduced as to the nature of the agency. The lungs were evidently considerably disorganised before death, and such extensive adhesions had taken place, that the ordinary rarefied air and floating particles of sand and dust, which sometimes render respiration difficult for even the strongest, might have readily proved fatal. This North wind however is exceedingly rare; the greatly prevailing ones of the hot season being Southerly, S. E., and S. W. The nature of these differs little if anything from the former, though the geography of the country and presence of so much water, might incline us to expect they would be somewhat moist and cool. Miles of the country in that direction are submerged during and for a long period subsequent to the inundation; but the solar radiation over the intervening desert dissipates all moisture, and the wind reaches us dry, hot, and scorching. Some idea might be formed of this dryness, by the rapidity with which water poured over the body and bed-clothes to induce rest and sleep dries up, and the apparent immunity that attends this kind of hygrometric experiment. And yet this wind bears in it no elements of positive mischief; on the contrary, I believe the hot to be the healthy and natural season in Upper Sind. Blowing over marsh and swampy districts it might be expected to come loaded with miasm, but the desert,

in dissipating the moisture, appears to operate likewise on the miasm; and relaxing, enervating, and subversive as it is of all physical and nearly all mental reaction, it is certainly not deleterious in a pathological sense. Hence the diminished number of well-marked fever cases. A kind of lethargy appears to supervene; bodily exercise is attended with very distressing feeling of failing vital powers, and the mental faculties must be stretched to the double to encompass their ordinary labors; but few of the recognised forms of disease are met with, they are reserved for the more favored season, and are among "the minor evils that man is heir to."

Such are the hot winds, which may be said to commence on an average in May and end in September. Their setting in however, as well as intensity and termination, varies almost every year. The cold winds commence generally from East, and vary from N. E. and N. to N. W., this last being unduly cold and biting. The hills in that direction may be sometimes seen covered with snow, and the wind in passing down loses a good deal of its watery particles, and reaches us rare and cutting.

Cold Winds.—This wind commonly occurs in January, but no rule applies. Under favorable circumstances of evaporation, ice may be sometimes seen at this time. During these months, the weather is at all hours cool and agreeable, though solar radiation is still powerful at midday. Warm breezes are unusual; but, on one occasion, I experienced a series of suffocatingly hot blasts in the desert of Kutchee. It was in the early morning, the thermometer could not have been 40°, considerable electrical disturbance was evident, and heavy banks of clouds and dust were rolling about. On moving through the dust, and in the intervals in which the clouds had appeared, there was a succession of hot and suffocating puffs, rendered doubly disagreeable to the feelings no doubt by the contrast with the general atmosphere. At the time I was inclined to attribute it to some gaseous combustion; but I now believe it admits of ready solution in the radiated heat getting, as it were, entangled in, and prevented to rise by the incumbent clouds, and thus involved, was carried on in the regular horizontal current. The phenomenon disappeared as the sun rose and dispersed the clouds.

Ignis Fatui, &c.—The quantity, however, of free gases, as shown by the number of so-called falling stars, and "Ignis fatui" is truly wonderful. On the arid plains of Kutchee, where scarce a trace of animal or vegetable matter is often visible for miles, these flitting lights are as common at the early part of the cold season as over the Lincolnshire fens, and their occurrence so common, and under such diametrically opposite circumstances, might well momentarily induce us to doubt the consistency of nature's laws. But the chemical constitution of the soil—abounding in phosphates and hypo-phosphates, particularly of lime, and the small quantity of moisture always present at this particular season, together with the well-known property of spontaneous inflammability possessed by phosphuretted hydrogen in contact with air, may probably account for the phenomenon. It would be impossible that the disintegration of animalcular matter (for of animal there is none), or of vegetable, of which there is scarcely a vestige, could produce such an almost innumerable host. I have counted no less than thirteen of those dancing "Will o' the Wisps" at the same instant, apparently never stationary, but always advancing and carried by the light wind at such a small and uniform distance above the level of the earth, as equally to entice but equally to elude the pursuer.

This phenomenon is, I think, confined mainly to the early months of the cold season; at least I have not seen it after the biting winds of January had set in. The intensely cold breezes alluded to, continue for a very short time, rarely more than a month. After this, the wind gradually shifts round to the East and S. E.; but sometimes the most sudden changes, as well as the most sudden shiftings take place, and the thermometer may vary from 38° to 50° under different winds, without any marked disturbance within the space of twenty-four hours. I saw an instance of such in February last. These are the ordinary season winds, and as their influence is directed more to the comfort or discomfort than to the wants of society, the subject is of much less interest than that of water.

Water.—Everything has been done to render the supply of water pure, abundant, and within the reach of all. It is attainable in sufficient quantity and of excellent quality throughout

the year, but towards the end of March and beginning of April the tedious process of drawing it from a well for all purposes, renders the first intimation of the water's approach a subject of universal delight. As an earlier or later inundation may depend on a variety of natural and local causes, so will our supply of water, but it is seldom later than April. It is usually ushered in by some slight atmospheric and electrical disturbance, consequent probably on the sudden diffusion of watery particles, the rapidity with which they are evaporated and condensed, the air at this early period, not being so uniformly heated as to cause secondary evaporation. The result generally, though not uniformly, is a slight thunder-storm, a little rain, and an apparent dust-storm. This last, an almost invariable attendant in the van of the advancing waters, is, to my experience, not a dust-storm in the proper acceptation of the term, but resembles the so-called "pillars of dust," and results from the heat evolved by the sudden condensation, giving rise to a variety of small local ascending currents, to which a kind of circular motion will be imparted by the ordinary horizontal current blowing in the direction of the advancing disturbing medium. The dust has no appearance of precipitation, which it undoubtedly would have in the true dust-storm.

The phenomenon, however, is exceedingly trifling, and only interesting or curious in the assumed regularity of its occurrence.

The first effects of the water are some slight diminution in temperature, owing to the quantity of heat made latent by evaporation; the air feels more light and buoyant, nature looks refreshed and invigorated, and a most pleasing sympathy between animal and vegetable life springs up for the moment. As is well known, the quality of the Indus water is unexceptionable, and the periodic cleaning of the canals renders it free from any mischief or inconvenience that might arise from the decay of animal matter, or of the rich and succulent vegetation which it promotes in its course. Cultivation advances rapidly, the water is drawn off into the fields on all sides, and vegetation and foliage, though in reality somewhat unnatural and forced, appear rich, healthy, and rejoices. The change alluded to as effected in the atmosphere by the water is, however, very transitory; owing to

the increasing intensity of solar radiation, the vapour taken up is inmediately dissipated, and either carried to such a distance over the desert, or, by secondary evaporation, raised to such a height above us, that rain clouds rarely form until late in the season, are very limited in amount, and irregular in extent.

Rain.—Thus we may hear of a very pretty considerable fall of rain within a few miles, without any indication whatever; sometimes slight clouds may appear in the distance. The direction of the rain (which I assume to be purely local) will be, from well-known physical causes, nearly vertical, and the drops very large.

Only about one inch of rain was registered at Jacobabad during the hot season of 1858, it fell towards the end of July and beginning of August. During 1859 no rain fell until September, most probably owing to the unusual power of the sun during that trying season in upraising and suspending the vapour at great heights. The quantity was in all about two inches, the direction completely vertical and drops very large. The effects of the rain will be a temporary lightening of the atmosphere owing to renewed powers of evaporation. It also imparts a grateful and healthy freshness to the leaves and flowers of trees and herbs.

During the cold season of 1859 no rain fell, but in the present we have not only had rain in considerable quantities, and at repeated intervals, but also a second plentiful supply of water to the camp in February. The fine and protracted inundation of last year, together with a more diffused system of irrigation, and good state of the canals to receive the infiltrated water, were no doubt the main causes of the unexpected boon.

Miasm.—Towards the end of October, the water begins to dry up gradually, and as it will be recollected that vegetable nature at the same time undergoes a change and prepares for winter, all the conditions favorable to the generation and spread of miasm are met with: rich and rank vegetable matter, with water, gradually becoming just sufficient for its disintegration. A cool wind now sets in towards evening from a northerly direction, and the vapour arising from the comparatively warm water of the tanks and nullahs, becomes condensed at a small distance, forming a kind

of fog, rendered very disagreeable by the superadded dust and smoke of camp. This vapour is precipitated during the night, and dew is a usual occurrence at this season.

Mirage.—From somewhat similar causes, I think that "mirage" results, which is so common at this time of year. That it is different in all respects, but most particularly in appearance from what we observe over dry rocky ground, or over our own parade ground at midday in June or July, was made very evident to me on ascending the Booghtee hills from the plains. In the one phenomenon (that over dry ground) which undoubtedly depends on the "refraction of rays of light in their passage through strata of air of different densities," the image is raised and assumes sometimes gigantic proportions, but I never saw any appearance of inversion. In the other, which occurs especially in the early morning over our level plains, and which is generally seen in the cool season, the image is both raised and inverted. This "mirage," a gossamer-like film undulating just above the surface of the land, appears in the distance like a broad sheet of water. Its cause will be found in the resistance offered by the cool atmosphere to the ascent of the scanty moisture from the over-heated earth. It will invert images precisely as water does, and often brings within our vision the depressed and low lying land, in the manner illustrated by our old school-boy experiment of raising into vision, by the agency of water, a shilling or other bright object at the bottom of a basin. This classification will, I think, be borne out by observation, though perhaps, as may be inferred from the difference of formation, there are few climates or countries of such intensity or peculiarity as Upper Sind to exhibit the varieties.

Dust Storms.—Another marked but far more disagreeable characteristic of our climate is the dust-storm. The explanation of this phenomenon will, I think, be found in the power possessed by heated air of carrying up loose and light particles of matter "familiarly seen in the action of heated air in a chimney," and illustrated in scientific records by the great shower of blood which fell in Hungary in 1828, and which was proved on investigation to have been caused by the pollen from certain plants in a neighbouring forest which had been raised

into the atmosphere and precipitated on the occurrence of condensation. Powerfully-heated currents carry up with them quantities of the light and loose-lying sand and dust, but "as currents ascend," according to Espy, "their power becomes gradually expended, and the light air with suspended particles spreads out and remains until so impregnated by successive currents that the dust will fall by its own gravity, bringing intermixed with it sufficient air of a different temperature to account for the atmospheric disturbance experienced on these occasions." Some few drops of rain generally precede or attend the storm, thus proving the condensation; but though it is I believe an accepted fact, I never could observe by the thermometer any lowering of temperature, until the dust was precipitated, when a slight cooling may be readily accounted for in the increased facility for evaporation. Their direction will be that of the prevailing winds, everything becomes enveloped in an almost palpable darkness, sometimes so intensified, that not even the most familiar objects, not even the hand in close proximity to the face can be discerned. The nearly imponderable particles penetrate the minutest crevices, and complete exclusion is impossible. A considerable disturbance in the electrical equilibrium usually accompanies these changes, but has, I think, no further connection with them than indicating the rapid changes that are being effected in the atmosphere by the power of the sun's heat. The quantity of electricity, judged by its distressing effect on the feelings, must be unusually great, and, as well as its tension, will no doubt depend on the powerful evaporation taking place, and the rapidity with which it is effected. Its precise effect on heat it is difficult to imagine, but on the free heat registered by the thermometer, and on which temperature depends, it is said to have none.

Solar Radiation.—Heat is generated solely by solar radiation, and in this particular we are most unfavorably situated both geographically and topographically. Being but a few degrees above the tropics, the sun's rays are nearly vertical, and as our almost uniformly level desert offers neither obstacle nor delay to the dispersion of partially-formed clouds, these rays act through a perfectly clear atmosphere, and consequently with full power. It is true that the earth also radiates

heat and the nights are sometimes really cool and tolerable; but when stillness prevails, or light clouds form as in 1859, they are of a description only to be realized by actual endurance. Even under the most favorable casual circumstances the radiation will be trifling, owing to the great incumbent pressure which must diminish to the utmost the capacity of the air for heat. The effect of this incumbent pressure, the result of the height and variety of atmosphere above us, may perhaps be best conceived from the theory of "Saussure," which has not been hitherto controverted, "that temperature decreases one degree in every hundred yards of ascent." Thus our topographical position, as alluded to in the first page, only raises us one degree and two-thirds out of the most unfavorable state that could be even theoretically imagined.

Climate.—It will not be therefore a matter of surprise that the climate of Upper Sind, and more particularly the frontier districts of Upper Sind, should be considered, if not the worst, certainly the most trying to the constitution of any in the world.

The average mean temperature during the hot months may be fairly stated at 93° day and night, with all doors and windows shut: the opening of a door will sometimes make a difference of five or six degrees. No doubt the greater diffusion of water will tend considerably to modify the climate, as also the more extensive planting of trees, which, if they exercise no other influence, will have at least a mechanical effect in arresting winds and clouds, and thus to some extent inducing the formation of rain.

From climate to cultivation and the products of the country will be a very natural transition, the latter being so influenced by and dependent on the former. The agricultural periods like the seasons are two, the hot and the cold months.

Cultivation.—As the climate in the early months may be pre-eminently classed among the "hot and dry," all agricultural operations will be based on the probable amount merely of artificial moisture to be obtained, and this leads, as might be expected, to a limited selection of the most succulent and rapidly growing vegetables and fruits for culture.

Botany.—But as I hope before long to be able to give some detailed account of the Botany of Upper Sind, I shall now merely

mention generally some of the common vegetable products of the place, without any reference to seasons or scientific arrangement further than grouping some of the best marked and most numerous varieties under their proper botanical orders.

Cucurbitaceæ.—In everything relating to this order, the natives of Sind appear to possess a considerable and somewhat accurate knowledge. The different species, various properties, effects of cultivation, and other peculiarities, seem well known and practically attended to in raising the almost endless varieties we find.

The quantity of Melons grown in Upper Sind is almost incredible, and though the heat is too powerful to admit of steady advance and the gradual development of those delicate properties so much admired, the loss is more than counterbalanced by the rapidity with which the market is supplied and the bountiful return yielded to trifling labor. A sandy soil and abundant supply of water afford every essential for their hasty production. The common pink (cabul water), and the musk and nutmeg (sweet), are the only kinds of melon found. But when an opportunity offers or the weather permits, a variety is brought from Candahar and Kelat (sardee), not inferior to any fruit in the world. If not already tried, it might be at Mahableshwur, and if successful would repay trouble. Of cucumbers the *Luffa acutangula*, and *pentandra* (Turaee, and Gheea turaee) grow well. The *Cucumis madraspatanus* (Chilbur or Kukree) is wholesome when cultivated, but of very doubtful properties in the wild state. It is indigenous in Kutchee and attaches itself to the leafless "Kurreel," hanging in handsome festoons, and rather a pleasant relief to the eye in that desert. The *Momordica balsaminea* (a little spiked bitter gourd) I have also found wild in the same place. It is eaten by the Belooch, but is unbearably bitter, and would prove injurious to any other family of the human race. The "Dilpu sund" is the only substitute for the potato when the heat banishes the latter. The Colocynth is found wild and widespread over the whole frontier districts of Cutchee and Sind. It may be interesting to observe that it is eaten by both fox and jackall. The carnivorous habits of these animals might almost lead us to expect that instinct teaches them its medicinal proper-

ties. The pumpkin (kumlah), *Cucurbita pepo;* the bottle gourd *Lagenaria vulgaris*, of two varieties; the "Tomba" or "Fukeer's drinking-cup" is intensely bitter and only used when emptied of the seeds in the manner indicated by its name; and the "Kuddoo," nearly allied to the *Benincasa cerifera* presented at marriage festivals in Bengal, all grow well. The last plant belonging to this order which I shall mention (the Ninda), is, I believe, unknown to botanists. It grows wild in some few places on the frontier. The dried fruit, which looks more like the thorn-apple than the gourd, is powdered and used as snuff in gravedo and all affections of the eyes and head, particularly of children. The knowledge of the plant, as well as of its uses, is confined to the natives of Sind. Its extreme simplicity of structure affords an excellent opportunity of examining the true placentation of the order, and fully establishes, I think, the views of Professor Lindley.

Leguminosæ.—Amongst the principal trees are the *Mimosa Sirissa*, of which, handsome foliage, rapidity of growth, and protective shade, constitutes the value. *Acacia arabica* ("Babul") yields a fine timber and a rough and coarse gum lac. The bark is used in tanning, and the pods and seed, mixed with flour, are eaten, though most powerfully astringent. *Acacia farnesiana* ("Bara") nearly similar, but not so general. *Acacia spicigera* ("Kendi") grows all over the jungle, and is a great camel fodder plant. The "Keekur," another variety of acacia with handsome broom-like flowers, yields a very coarse gum and soft and useless wood. Two or three varieties of Senna, *Cassia sophora*, and the beautiful looking *Cassia fistula* or *Cathatocarpus fistula*, are both used medicinally; the latter grows in great abundance and extreme beauty in the hill districts. The *Bauhinia montana* ("Kuchnar") or mountain ebony; the bark is used in tanning, and the flowers of great beauty. *Sesbania ægyptiaca* ("Jeet") forms nearly all the hedgerows about the station; also *Sesbania grandiflora* ("Conasan"), and an edible variety ("Eekur") the dried leaves of which are sold in the bazar. The *Poinciana pulcherrima* (Barbados flower fence), the horse-raddish, and tamarind tree thrive excellently. The Indigo plant appears to be well suited to the soil of Upper Sind, and may yet become one of the staple products of the country. A wild plant, the *Indigofera pauciflora* (Jhil), is found about in some

places: use, Hindoo tooth-brushes. The *Dalbergia sissoo* produces the Sind blackwood, and seems adapted to the climate. *Crotolaria juncea* ("Juni or Jun") extensively cultivated, but seems to yield only a coarse fibre here, chiefly employed in the manufacture of coarse bags and seleetahs.

Before mentioning the varieties of pulse found here, I may remark that diarrhœa and dysentery have been often traced to the use of dholl in public institutions, and has frequently led to its prohibition. As far as I have seen, this is often, if not always, to be attributed to the admixture or wholesale use of inferior varieties known as Mout and Mohar (*Phaseolus aconitifolius* and a variety of *P. radiatus*). At best they are exceedingly coarse and sour; but their mode of cultivation in Sind, amongst the jowarree, renders them dangerous articles of human food. The following are the best varieties, and may be easily known by their size and fulness :—

1*st*. *Cytisus cajan* ("Turar"), a kind of pigeon pea. The shrub is somewhat like a Sabuenan, and is sown chiefly in gardens or among cotton plants. 2*nd*. *Phaseolus mungo* ("Ooreed"), of rather astringent properties. 3*rd*. *Ervum lens* (lentil "Mussoor") small. 4*th*. *Phaseolus radiatus;* and 5*th*. *Phaseolus max*, known as green and black "moong :" the former a well-known ingredient of the mullagatawnee, and the other the most generally used for food by the natives of India. 6*th*. *Phaseolus lablab*, ("Watana,") eaten parched. 7*th*. *Cicer arietinum*, or black Bengal gram, and white Cabul. There are endless varieties of green pulse known as Chowlee and Seeun which it would be impossible to mention here, and a great number of wild leguminous plants that will be best understood from the specimens I intend forwarding.

Solanaceæ.—Almost all the cultivated plants of this order grow here. Tobacco thrives well in the red soil of Cutchee, and near every village one or more patches of land will be found laid out for its cultivation. Potato, the egg-plant, tomatas, &c., and many varieties of pepper grow exceedingly well. The chief wild plants are the *Datura stramonium* ("Dootura"), the *Solanum decem dentatum* ("Mukkoo"), the small black fruit of which is eaten under the general name of "Peroo ;" a wild variety of Peruvian winter cherry, *Physalis angulata*, called by the Belooch

"Chimthee," grows under the hills and is sparingly eaten. The "Prince" and other varieties of *Physalis* grow all over the hill districts; the fruit gathered in July and sold in the Bazar is highly esteemed for its medicinal properties. An infusion of the berries is, in small doses, an expectorant—in large, an emetic.

Of Malvaceæ.—The same may be said in reference to the cultivated varieties. Amongst the wild are the *Urena lobata*, used in many places for cordage, but not that I am aware about here; and the "Dopureea," a variety of Pentapetes, with a remarkably pretty flower. It springs up immediately after rain, and is one of the most attractive wild flowers we have.

Cotton.—But the principal plant of this order is the *Gossypium*, or cotton plant. So much has been already written regarding adaptability of soil, modes of culture, and probabilities of success, that the subject of cotton cultivation is theoretically at least nearly exhausted. The presence of all the conditions necessary for its healthy production are generally admitted, and skill in their application alone appears wanting. This want seems to me to apply chiefly to irrigation—a process at present most recklessly carried out. As a plant may be broadly stated to live by its roots and flourish by its leaves—the latter elaborating under the influence of light and heat all the materials taken up by the former—it follows that as exact a relation as possible should be maintained between the two. But when materials are unduly or too rapidly taken into the vegetable cells, this co-relation is destroyed, and vegetation will predominate to the detriment of inflorescence and fructification; and, such I believe is precisely what happens with us. The earth, instead of being so prepared as to admit air and water to the rootlets, and to run off the surplus, is rough and level.

The water is let in with a rush, bringing along with it the germs of many noxious plants, among which I have chiefly noticed a very coarse kind of bean-caper, a species of Achyranthes, probably "aspera," and the "uxgree," or poison plant of the natives—a variety of "Didymocarpus." Once admitted, water and weeds are allowed to do their worst, and the result is, quantities of succulent, but sickly, leaves and branches, which soon perish and fall off.

It is no doubt absolutely necessary, in a climate like ours, to

promote vegetation by artificial means; but the object should be to promote it only in as far as is consistent with the healthy life of the plant. The heat and dryness of our atmosphere are well calculated to effect those chemical changes conducive to the formation of flowers and fruit, the main object of every cultivator of cotton. At present the produce is exceedingly small; but the fields are never laid out or sown purely in relation to a cotton crop, and not unfrequently two or three different descriptions of plants may be seen in the same plot of ground. The seeds are generally sown in March; flowers rapidly form in May, and yield cotton in June: but in the rich brown and red loam of Cutchee, where the supply of water is of necessity more limited, the roots sink deeper, the plants grow higher, and flowers rarely form before September: fructification, however, bears a much fairer relation to vegetation than in Sind. The flowers are very numerous; and though, owing to want of skill and attention, scarcely a three-fourth ripens, the yield is still said to be fair. The varieties of the cotton plant found in Sind are—1*st.* "*Gossypium obtusifolium*," met wild in many places by Dr. Stocks, but I think will be found chiefly confined to Lower Sind, where the atmosphere is moist. I have at least not met it as yet. The very fact of its being found wild is, however, a significant proof of the adaptability of both soil and climate. 2*nd.* "*Gossypium arboreum*;" triennial: grows to a fine size, particularly about Shikarpoor, but produces very little cotton, and of a very coarse description: the red flowers are rather showy. 3*rd.* "*Gossypium herbaceum*:" most generally cultivated, and almost the only variety ever seen in Cutchee, where it grows to about four and a half feet high. It is known by its yellow flower, with purple spot on the claw of the petal. Another variety, which I understand is every year becoming more prized, will probably be found to be the *Gossypium hirsutum*: flowers white; leaves soft and downy; stem hairy, whitish, and slightly dotted. I have not had many opportunities of seeing the plant in flower. These two last are triennial as regards the plant; but producing little or no cotton, are seldom left in the ground or looked to after the second picking.

Infusions of cotton seed are highly prized by native practitioners as emollients and demulcents.

Convolvulaceæ.—We have a good many plants, wild and cultivated, belonging to this order. The latter have been chiefly introduced, I believe, from Kurrachee. The sweet potato grows very well. The *Ipomea pescapræ*, *Evolvulus alsinoides* with handsome blue flowers, and the *Ipomea reptans* flourish well. This last, an highly esteemed vegetable ("Naro") among the native community, grows most luxuriantly on the banks of all the nullahs and tanks. Another very pretty plant, called "Senni" by the Sindees, grows wild all over the jungle; its medicinal properties (demulcent) are in high esteem. In addition to the above plants, which for convenience I have arranged scientifically, there are many others useful and interesting, some of which I may mention. The "*Salvadora indica*," the berries called "Peloo," are eagerly sought after as food by the natives of this country, and resemble capers in appearance. The wood is highly prized as, owing to its acrid properties, it resists the attacks of white ants. *Salvadora persica* (mustard tree of scripture) I have seen in the jungle about Kusmore, and on the Punjaub frontier. The root is very acrid, and used, I was told, to raise blisters. *Capparis aphylla* ("Kareel"): the berries, though intensely bitter, are eaten by the Belooch. The fruit of *Zizyphus Jujuba* ("Baer"), *Cordia latifolia* and *myxa* ("Lusoree"), *Grewia asiatica* ("Phalsa"), *Feronia elephantum* ("Koort") wood apple, are eagerly sought after as delicacies. The handsome and very peculiarly formed leaves of this last plant, contain numerous receptacles of essential oil, yield a rich and agreeable perfume when pressed, and possess highly carminative properties.

A variety of *Mimusops*, probably *hexandra* "Kher-nee," a soapy kind of fruit eaten by the poor; the Java plum, "Jaman," and a curious description of wild almond I found at Dadur, "Badam-a-handee," the rind of which is sold in the bazars, and used for flavouring curries, and the kernel eaten,—constitute, I think, the principal native indigenous fruit and berries. The tamarisk yields in the cold weather a very coarse kind of manna, which is picked in the early morning before the sun rises, and eaten by the very poor. It would be tiresome to mention the almost innumerable varieties of wild "Sags," or native vegetables, but it may be interesting to see the dried specimens which I shall forward on an early occasion.

Cultivated Vegetables.—They are chiefly "amaranths, and purslanes," and nearly all possess antiscorbutic properties. I may mention that the chief cultivated varieties are the "Dill" *Anethum graveoleus*, "Saura." The seeds are carminative, and an infusion generally given to women after parturition. *Fenugreek; Trigonella Fænumgræcum* ("methee"), the seeds are used medicinally in dysentery; *Trigonella corniculata* ("paluk")—these three plants are largely cultivated for food, particularly by the people of Cutchee, also "Dhoonea" (Coriander). The principal oil plants are the till and mustard.

The *Calatropis gigantea*, "Ak," or milk-bush contains a very acrid juice, which substitutes croton oil in the native pharmacopœia. The castor-oil plant is indigenous to Upper Sind. The bamboo and sugarcane grow only in a very few places: of the *Cannabis indica* a little is found around every house belonging to the poorer classes, who cannot afford to buy intoxicating drinks. Of the "cereals" it is merely necessary to say that the wheat fields near the river look charming. The produce is well known. Oats, I am told, would thrive equally well if any purpose could be served by its introduction. The sweet "Jowarree" is being largely introduced, and will no doubt prove an important benefit.

The tuber of the *Arum Colocasia* "Ghooeean" is sometimes substituted for the potatoe during the hot months, but is coarse and tasteless.

The only sacred plants I have met with are the *Ocymum sanctum*, "Tulsee," said to be used in the administration of the Hindoo oath, and sacred to Veshnoo; and the *Poa cynosuroides*, "Koosheran," a kind of meadow grass, employed in the festival of Sewrath and in funeral rites.

A coarse cordage is also manufactured from its fibres, and used in the construction of charpoys.

A decoction of a species of prickly *Argemone* is extensively used by Mahomedan practitioners in sun-stroke, and sometimes, I apprehend, to procure abortion.

A variety of *Cactus*, known as "Morpita," is highly spoken of by the hill tribes as a febrifuge. It is to be found, together with the fan palm, on those bare limestone rocks; and like all plants of its order, resisting transpiration, abounds in an intensely bitter watery fluid. It is one of the drugs most highly spoken

of by the natives, and I have procured an infusion for analysis.

It would be difficult to particularise any medicinal plants without a good deal of experience. As for the native materia medica, it extends over the whole vegetable creation of the country; but their knowledge, I must say, is much more general than accurate, and their practice, as a rule, has reference rather to the seasons than to actual disease.

Native materia medica.—The unvarying answer, as to why they use so many plants of acknowledged different properties in the same disease, is, that they all participate in one common property of causing heat or cold, and in that lies the great secret of cure. They have many "specifics," none, as I can gather, of any importance. The Neem is in the same high esteem as in other native pharmacopœia; with the addition that the oil extracted from the seeds is said, if steadily taken for a few months, to render the body proof against snake bite. Medical skill is, however, in a much more advanced state than surgical, which is at once of the rudest and most daring description that can be conceived.

Surgery.—The grand operation "Firing" is performed in every instance of enlarged organ or gland. The iron laid on at red heat must, from some cases I saw shortly after the operation, be applied with no sparing hand. Innoculation is said to be extensively practised in the hills; and one unfortunate instance I met of lithotomy amongst the Booghtee tribe. The incision had been made alongside the raphé, not half an inch in length, and both urethra and rectum had been either cut into during the operation, or subsequently penetrated by ulceration. The poor boy had then survived the operation nearly two years; but was, as might be imagined, in a most deplorable state.

Social Condition.—But, primitive and rude as is their practice and skill, their mode of life is probably amongst the wildest and poorest in the world, and bad food, bad air, and no protection against the intensity or inclemency of the climate, are the main causes of the comparative depopulation, and, at the same time, of the moral inferiority so often and unjustly insinuated as an inborn and transmitted peculiarity of the natives of Sind. Their manly figure is not inferior to any: superior to most other eastern races.

In the vicissitudes through which they have passed, and the depredations to which they have been subjected, we must seek the cause of the implied degradation, and of that absence of increase which has never yet allotted two millions of inhabitants to a land capable of supporting five times that number. On the frontier we have a mixture of many races. The Belooches, who may be said to inhabit all the country from the Halla range Eastward to Western Persia, represent the wild Arab tribes as I have seen them in Syria, under a less interesting and very degenerate aspect. The regiments at Jacobabad are, I believe, mainly composed of natives of Hindustan, Punjaub, and the Dekkhan; and are, to my experience, almost as susceptible, though perhaps more tolerant of the severe influences of climate, as Europeans. It is usual to speak of their becoming acclimatized; but the expression—of doubtful signification under any circumstances—is, I think, in this instance inadmissible. They cannot, and do not I believe, maintain their vigour unimpaired by climate, nor transmit to generations that comparatively warlike spirit and restless energy for which these races are more or less renowned.

Since writing the above, I have had an opportunity of reading, in the last or 5th Volume of these Transactions, Dr. Cook's Meteorological report of part of Beloochistan, in which he connects electricity with dust-storms and like phenomena in the relation of cause and effect. A similiar opinion I have heard given by General Jacob, who had no doubt seen more of these storms than any living man of science. However, from my own limited and distasteful experience, I am inclined to account for their occurrence simply on the natural processes of evaporation and condensation, and the lightning as merely a concomitant effect of the same causes. The greater quantity of electricity, as well as variation of tension, will, at the same time, I think, be explained by the intensity and rapidity with which these changes are effected,—a natural consequence of the intensity of solar radiation; the parent, I believe, of all the phenomena witnessed in our climate. I am not aware of any experiments yet made to ascertain the probable power of this radiation; and indeed, imperfect instruments, and other difficulties attendant on carrying out experiments here, render any attempts a matter of long delay.

ON THE INTRODUCTION OF THE CINCHONA PLANT INTO INDIA.

BY CLEMENTS R. MARKHAM, Esq., F.R.G.S.

The present attempt to introduce the species of cinchona trees yielding quinine and other valuable alkaloids into India, cannot fail to have excited attention not only in the medical profession, but also in all who take an interest in the welfare of our Indian Empire. In the present paper, therefore, I propose to give some account of the nature of those forests in South America of which the cinchona trees are natives, and of the conclusions I have formed after examining some of the hill districts of the Indian peninsula, as to the localities which are likely to be most suitable for the culture of these valuable plants in this country. In the first place, however, it will be well to give a few details respecting the causes which have made this measure so important, to pass in review the attempts which have formerly been made to introduce the cinchona, and to state the measures which I took when the conduct of this important experiment was entrusted to me, and the present prospects of its final success.

C. condaminea (Crown-bark).—It is unnecessary to give any account of the well-known story of the cure of the Vice-queen of Peru in 1639, and of the first arrival of Peruvian or Jesuits' bark in Europe; but from that time the demand for bark, though slowly and with many fluctuations at first, has steadily increased. For a century the plant from which the bark was procured, remained undescribed; and from 1638 to 1776 no other bark was met with in commerce, besides that which cured the Countess of Chinchon, which was first described by M. La Condamine, which was the only one known to Linnæus and named by him *C. officinalis*,* and which is now more appropriately known to

* In 1742 Linnæus first established the genus Cinchona.

botanists as *C. condaminea* (vars. *Uritusinga* and *Chahuarguera*), a name given by Humboldt and Bonpland. This species is found in the forests of Loxa, in the Republic of Ecuador.

C. lancifolia (Carthagena bark).—In 1772 that great Spanish botanist Don Josè Celestino Mutis, discovered a cinchona in the forests near Bogota, growing at a great elevation, and within the region of frosts, now known as *C. condaminea* (var. δ *lancifolia*), and from 1776 its bark began to be exported from the port of Carthagena to Cadiz,—3,000,000 lbs. being shipped from 1802 to 1807.

C. nitida, *C. micrantha* (Grey barks).—The next barks which came into the market were those known as grey barks, which, though not used in the manufacture of quinine, command a good price, and yield the valuable alkaloid called cinchonine. They were first brought into notice by the Spanish botanists Ruiz and Pavon, who described the trees from which the grey bark is taken, naming them *C. nitida* and *C. micrantha*; * and passed some time in the Peruvian forests of Huanuco, where they grow. The researches of these botanists in South America extended over a period from 1778 to 1788.

C. calisaya (Yellow bark).—The cinchona-tree yielding yellow bark, which has long been considered the most valuable of all, was discovered in the forests of La Paz and Cochabamba, in about 1785, by a Spanish naval officer named Rubin de Celis, in company with the German botanist Taddæus Haënke. In 1789 this bark first began to be imported into Cadiz; and in 1820 the tree from which it came, the *C. calisaya*,† was generally known as the best species of cinchona.

C. succirubra (Red bark).—Finally the species yielding red bark, first described by Pavon as *C. succirubra*, but as

* The *C. micrantha* was, in fact, first discovered, described, and named by Tafalla, the pupil of Ruiz and Pavon, in 1797.

† The derivation of the word *Calisaya* has been variously given. Weddell says it is from the Quichna words *Colli* (rouge); *Saya* (forme). Poeppig derives it from *Colla* (a remedy) and *Salla* (rocky ground). Von Tschudi says it comes from *Colli sara* (brown maize)!! My own opinion is, that it is derived from the two Quichna words *Coali* (strong) and *Sayay* imperative of the verb *Sayani* (to prepare).

yet little known to botanists, is now beginning to rival the *C. calisaya* in value. It is found in the forests, at the foot of the great mountain of Chimborazo, in Ecuador.*

When I was entrusted by the Secretary of State for India with the duty of conducting the present experiment, I determined to take steps for procuring and introducing into this country all the above species, namely :—

C. condaminea (Crown bark) from Ecuador.
C. succirubra (Red bark) „ „
C. lancifolia (Carthagena bark) from North Granada.
C. nitida }
C. micrantha } (Grey barks) from Northern Peru.
C. calisaya (Yellow bark) from Southern Peru.

The greater the number of valuable species introduced, the greater the chance of success, the more complete the experiment, and the more numerous the chances of finding suitable localities for their cultivation in India.

Rapid destruction of Cinchona trees.—Improvidence has always been the chief characteristic of the Spanish colonial system. For many years no attempt whatever was made to develop the resources of the magnificent countries in South America which the Spaniards had conquered. The whole energy of their Government in Peru, was directed to procuring the precious metals, to the entire neglect of all real sources of wealth, and so reckless was the oppressive cruelty with which they forced the Indians to work in their mines, that, in three centuries, they reduced the native population from certainly over twenty millions in 1560, to barely one million and a half in 1860. The same reckless folly which led them into this course of ruinous cruelty, induced them also to waste and destroy the cinchona forests, and to mix and adulterate the barks, for the sake of immediate gain.

Destruction of C. condaminea.—The improvident felling of cinchona trees, which is now causing grave apprehension that

* *Quina* predominates in yellow barks, exists in red barks, but there is hardly any in grey barks.

Cinchonia (the base of cinchonine) predominates in grey barks.

Quinidia is found in Carthagena barks.

the supply of quinine may soon fail, was noticed upwards of 120 years ago; so that a warning voice was raised in time, had the Government or people of South America been capable of forethought or prudence. As long ago as 1735, Don Antonio de Ulloa, a naval officer who was engaged in collecting information in South America for the Home Government, wrote that "the Indians who collected this valuable bark near Loxa, do not take the necessary trouble to separate it from other species, though the botanist, M. de Jussieu, explained to them that this negligence caused the fall in the price of bark. When they collect the bark, they first fell the tree, and then peel off the bark; and as they do not take the trouble to plant other trees in the place of those which have been felled, there can be no doubt that, in time, these forests will be stripped of them; because, though they are numerous and wide-spread, they have an end."* He goes on to recommend that an order should be issued, that a young plant is to be planted whenever a tree is felled, on pain of a fine. Nothing of the kind, however, was done by the authorities. These remarks refer to the species yielding Crown Bark (*C. condaminea*). The destruction of the *C. calisaya* did not commence until some fifty years afterwards, but it has gone on with perhaps greater rapidity: while at the same time the trees have been the subject of much meddling legislation on the part of the South American Republic of Bolivia, within which territory chiefly they have the misfortune to grow.

Legislation respecting C. calisaya.—In 1830, the price of Calisaya bark fell so low, that the Bolivian Government deemed it necessary to regulate the trade of so valuable a product. It was then determined to grant the exclusive right of exportation to a National Company. Meanwhile the cutting of the trees caused rapid destruction, and at last it was prohibited for 5 years; but the decree was abrogated long before the end of that time, and a duty of 12 to 30 dollars the cwt. was placed on exported bark. In 1844 the Bolivian Congress decreed the formation of a National Bank or Company to export all bark, on payment of a fixed

* Noticias Secretas, p. 572. La Condamine, in 1737, also says that, owing to the wasteful cutting of the trees, those of large size had become scarce, even in his time: and Humboldt states, that not less than 25,000 trees were destroyed in one year.

duty. This monopoly was, in 1845, granted to one Jorge Pinto for 5 years, who was to pay $ 119,000; but the measure was very unpopular, and was put a stop to in 1849, when free commerce in bark was again established, the duty levied being $ 20 the cwt. In 1850 a second monopoly was granted to the brothers Aramayo, who engaged to pay $ 142,000 a year, for the exclusive privilege of exporting bark; and in 1851 banks of bark were formed both at Cochabamba and at La Paz; but in 1858 free trade was again established with an *ad valorem* duty of 25 per cent.; and a second decree, reducing the duty, appeared in November 1859.*

Bolivian bank of bark.—This constant vexatious legislation has arisen, of course, from the restless anxiety of the Government to make as much as possible out of this the most valuable product of the country. The bank, during its existence from 1851 to 1858, paid $60 per cwt. to the bark collectors for the bark; gave $25 per cwt. as a duty to Government, $ 12 per mule load of 300lbs. for freight to the coast, and sold it at the port for about $150 per cwt. The bank, for some years, received as much as 1,400,000 lbs. of bark a year.

Destruction of C. calisaya.—Yet with all this amount of interference in the trade, no attempt whatever has been made to preserve the trees, and the words of Dr. Weddell on this subject are remarkable. He says, "whatever may be said, the forest of Bolivia, rich as they are, cannot resist much longer continual attacks of the kind to which they have recently been subjected. He who, in Europe, sees the arrival of enormous and ever-increasing quantities of bark, may well believe that this will continue; but he who seeks to know how things really are in the native region of the cinchones, will find himself obliged to think far otherwise. One fact will suffice to show the constant and progressive diminution of the cinchona trees. Where formerly one met with them everywhere in the vicinity of villages, now to find a tree of a few decimetres in diameter, it is necessary to make a journey of several days duration, into the bosom of the forests."†

* Decree of President Linares, dated November 17th, 1859.

† Weddell, p. 244.

Personal observation.—Dr. Weddell speaks of Bolivia, and I am able to bear testimony to the truth of his statements, so far as the adjacent forests of Peru are concerned. During my frequent journeys through various parts of the forests of Caravaya, though young plants and root-shoots of the *Calisaya* abounded, I never once met with an old tree. They had all been felled. Mr. Spruce too tells me that, in some of the cinchona forests of Ecuador, there does not remain a single tree large enough to produce seeds.*

Importance of introducing the Cinchona plant.—Considering these facts, and the immense value of the quinine which the bark of the cinchona yields, it will at once be seen that the introduction of the plant into countries where attention would be paid to preserving and propagating it, as well as to collecting its bark, must be a matter of very great importance to all civilized countries, and especially to India. Accordingly, the project of obtaining plants and seeds of the cinchona has, from time to time, engaged the attention of more than one European Government.

Condamine's first attempt to transplant the Cinchona.—The first attempt to transplant live plants of the *Cinchona* was made by M. La Condamine in 1737. He says, "I selected some young quinaquina plants at Yangana, which I intended for the *Jardin Royal des Plantes*, flattering myself that I should be able to take them at least as far as Cayenne, and there leave them in depôt, to be transported to France. But the same wave which washed over my boat at the mouth of the Amazon damaged the poop, and carried off a box in which I had preserved them for more than eight months. Thus I lost them, after all the trouble I had taken during a voyage of upwards of 1200 leagues."†

Dr. Ainslie's Suggestion.—The first idea of introducing Cinchona plants into India, was probably suggested by Dr.

* As an exception to this improvidence, it ought to be mentioned, that in the forests about the foot of Mount Chimborazo, those who cut down bark trees are said to be in the habit of breaking off young branches and sticking them in the ground, where most of them take root.

† Voyage de la Condamine, p. 31.

Ainslie, who, half a century ago, remarked that it is matter of regret that "it has never been attempted to rear those articles of the Materia Medica in India, for which the world is now solely indebted to America."*

Dr. Royle's Suggestion.—The late Dr. Royle, however, was the first person to recommend the introduction of the Cinchona into India, in his work on Himalayan botany in 1839.†

Labours of modern Botanists.—Twenty years was to pass away before any attempt to carry out this suggestion was to be made, and, in the meanwhile, the labours of botanists were to add materially to our knowledge. M. Poeppig in 1832-34 examined the forests of Huanuco, and supplied us with much valuable information respecting the habitat of the species yielding grey bark.‡ Berthold Seaman visited and reported upon the forests where the *C. condaminea* grows near Loza.§ Dr. Karsten gave us the results of his important botanical labours in New Granada;¶ and, above all, Dr. Weddell, the highest modern authority on the subject, published his invaluable monograph on *cinchonas*.**

Dr. Weddell first entered Bolivia in August 1845, as botanist to Count Castelnau's exploring expedition, sent out by Louis Philippe. In 1846 and 1847 he examined the cinchona forests of Bolivia, and of Caravaya and Santa Anna in Peru; being the first to describe the *C. calisaya*, and several other new species and varieties discovered by himself; †† and he visited the cinchona forests a second time, a few years later.

Dr. Weddell's seeds.—Dr. Weddell transmitted a great number of seeds of the *C. calisaya* to Paris, some of them came up in the Jardin des Plantes, and presents of the young plants were made to the Horticultural Society in England and to the Dutch botanical gardens.

* Materia Medica, p. 66, *Note*.

† Some time previously M. Fee recommended the introduction of Cinchona into the French Colonies (Cours d'Hist. Nat. Pharm. p. 259.)

‡ Poeppig Reise, 2 vols.

§ Voyage of the "Herald," 2 vols.

¶ Die Medicinischen Chinarinden Neu Granadas.

** Histoire Naturelle de Quinquinas. Paris, 1849.

†† Voyage dans le Nord de Bolivie.

Attempts of Dr. Royle.—At about this time, the subject of introducing the Cinchona plant into India was again brought to notice in a letter from the Calcutta Government to the Home authorities, dated March 27th, 1852; upon which Dr. Royle drew up a report, which led to a request being made to the Foreign Office that the Cinchona plants and seeds might be procured through the instrumentality of H. M.'s Consuls in South America. As was to be expected this measure led to no useful result. Mr. Cope, the venerable Consul General of Ecuador, was the only one who transmitted any plants, and they all died on their arrival in England, in December 1853. Some seeds of the *C. calisaya*, procured through Mr. Pentland, and six plants contributed by the Kew and Edinburgh gardens,* however, were taken to Calcutta by Mr. Fortune; but the seeds never germinated, and the plants all died in their removal to Darjeeling. In spite of this failure, Dr. Royle, who took the deepest interest in the subject, drew up another report in May 1853, and in March 1856 he proposed that Dr. Jamieson of Quito should be commissioned to collect plants of *Cinchonæ*, common in Ecuador. This was the last step taken, previous to my appointment.

Attempts of the Dutch.—The Dutch Government had also made attempts to procure plants and seeds for introduction into the island of Java, through their Consuls in South America, which failed; but in 1853, M. Hasskarl, formerly in charge of the botanical gardens in Java, was sent from Holland, to collect cinchona plants and seeds in Peru. During the year 1853 he collected some seeds in the forests of Tarma, of species of *Cinchonæ* which are of no value†; and in 1854 he obtained 400 plants which had been collected for him by a native agent, and which he conveyed across the Pacific to Java, reaching Batavia in December 1854. Several seeds of the *C. lancifolia* were presented to the Dutch authorities by Dr. Karsten, and a plant was also procured, which had been raised from seeds sent to Paris by Dr. Weddell. Only two of the plants of M. Hasskarl's collection survived the voyage across the Pacific.

* Raised from Dr. Weddell's plants.

† Namely of *C. amygdalifolia*, *C. pubescens*, *C. ovata*, Ruiz and Pavon's variety.

Success of the Dutch.—Thus the experiment of introducing cinchona plants into Java was commenced. The only valuable species they have obtained are the *C. calisaya* and *C. lancifolia*, as the *C. succirubra* is, I have good reason to believe, placed by mistake in the list lately procured by Dr. Macpherson; and it is to be remembered that none of the gentlemen who have had charge of the Java plantations, are personally acquainted with the forests where these species of *Cinchonæ* grow.

Sites selected by the Dutch in Java for Cinchona plantations.—In 1854, M. Teysmann prepared ground for a cinchona plantation at Tjipannas, at a height of 4700 feet above the sea, on the slope of the Gede mountains; and, when M. Hasskarl took charge of the experiment in 1855, another site was selected at Tjibodas, half a mile from Tjipannas, and 4,400 feet above the sea. These places are about 30 miles South of Batavia; and some smaller plantations were also established on the South side of the great Malawar range, 85 miles from Batavia, and about 20 from the South coast, in the Preanger regency. Tjibodas and Tjipannas were found unsuitable localities, owing to the shallowness of the soil, the want of shade arising from the unwise felling of the trees, the attacks of rhizanths, and the strong S. W. gales during the rainy season.

Species introduced by the Dutch.—In 1858, Dr. Junghuhn, an eminent Dutch naturalist, took charge of the experiment, and formed another plantation at Wonodjampi, on the Eastern and driest side of Java, 6,830 feet above the sea. At that period the list given of cinchona plants in Java is as follows* :—

80	*C. calisaya*, raised from Weddell's plant and from seeds.
13	*C. lanceolata*. This is a very doubtful species.
3	*C. lancifolia*, raised from Dr. Karsten's seeds.
148	*C. ovata*. This also is a doubtful species.
244	

With regard to the *C. lanceolata*, a plant was so named by Ruiz and Pavon, but Weddell excludes it from the list of

* Bonplandia, March 1858.

cinchonas.* The *C. ovata* was so called by Hasskarl, but Dr. Junghuhn, as will be seen below, has changed it to *C. lucumæfolia*, which it cannot well be, as that variety of *C. condaminea* does not grow in any part of the country visited by M. Hasskarl, who obtained the seeds of this plant. It is probably a species of no value. The following is the list in 1860, obtained by Dr. Macpherson:—

C. calisaya	15,819	
C. lucumæfolia ..	9,20,068	*C. ovata* of the former list.
C. lanceolata ..	45	
C. succirubra ..	35 ?	
C. lancifolia ..	14	
	9,35,981	

Results of the Dutch Experiment.—The experiment is now in charge of Dr. Junghuhn, and Dr. de Vriese, a professor of chemical science in Leyden University; and it appears that considerable success has attended their efforts to propagate the plants; though Mr. McIvor, the Superintendent of the Government gardens at Ootacamund, considers their system of culture to be most erroneous. The sites selected appear, from the reports, to be suitable, having been chosen as nearly as possible according to the descriptions given by Meddell and Poeppig, though not by any one who has personally examined the situations most favorable for the growth of cinchona trees in their native forests. Thus no advantage can be obtained from comparing the sites of the Java plantations with those which have been chosen in India, the former having been selected by persons unacquainted with the cinchona forests, and the latter by myself, after having carefully examined the native habitat of those plants in Peru.

Organization of the attempt to introduce Cinchonæ into India.—When, in the summer of 1859, my services were accepted by the Secretary of State for India, to conduct the attempt, then in

* Weddell admits 19 species of cinchonæ, and makes 2 doubtful. Out of the 19, only 8 are of the least value for obtaining quinine or cinchonine. He excludes 73 plants, once called cinchona.

contemplation, to introduce cinchona plants into India, I determined to take measures, as before stated, for procuring at least six of the most valuable species, scattered over four distinct regions separated by many hundreds of miles from each other. The regions referred to are Caravaya, the region of *C. calisaya*, in Southern Peru; Huanuco in Northern Peru, where the species yielding grey bark are met with; Ecuador, the home of *C. condaminea*, and the red bark species; and New Granada, where the *C. lancifolia* is found. Unfortunately I was only able to organize attempts in the three first of these cinchona regions.

Chief requisites for such an enterprise.—It will easily be imagined that the difficulties and dangers of such an enterprise, as well as the numerous risks of unavoidable failure, were by no means contemptible. The chief requisites for those engaged in collecting plants and seeds were a thorough knowledge of the country, the people, and the languages, as well as an intimate acquaintance with the forests and the valuable species of cinchona trees, rapidity in performing the work which is equivalent to economy; and tact to ward off the jealousy of a benighted Government and the fanaticism of an ignorant people, who imagine that their trade will in some way be injured by the introduction of quinine-yielding plants into other countries.

The Caravaya region.—I myself undertook the Caravaya region, the locality where *C. calisaya* is found, having, during my previous travels, become acquainted with the forests of Southern Peru. For procuring the species in Ecuador, I secured the services of Mr. Spruce, a very excellent botanist, who is thoroughly acquainted with the country; and for those in the forests of Huanuco, I employed a Mr. Pritchett, who had also passed some years in South America.

There is not space here to give a detailed account of my proceedings in Peru, more especially as my Reports to the Under-Secretary of State for India has already been published;* as well as a paper, giving a geographical account of the country

* In the Madras Times, November 2nd and 5th.

which was the scene of my labours, communicated by me to the Bombay Geographical Society.*

It will be sufficient here to say that, after much hard work and difficulty, and after having overcome considerable opposition from the native authorities, both in the interior and on the coast, I succeeded in embarking 15 Wardian cases, containing 456 plants of valuable species of *Cinchonæ*,† the vast majority being *C. calisayas.*

A few were left at Kew gardens, and the remainder reached Ootacamund, in the Neilgherry hills, last October; where, owing to the intense heat of the Red Sea, nearly the whole of them have since died. A second, though much smaller supply will, however, be sent from England next autumn; and I also expect to be able to procure seeds of *C. calisaya* from South America.‡ This unfortunate result was owing to the extreme length of the voyages, and the heat to which the plants were exposed; and it is now much to be regretted that a steamer was not furnished to convey the plants direct from the West coast of South America to India, in which case I feel assured that a large proportion would have been saved. It is right, however, to add, that out of M. Hasskarl's collection, which had the advantage of being conveyed from Peru to Java by the direct route, only 2 plants survived out of 400.

The Huanuco Region.—Mr. Pritchett also succeeded in procuring a supply of plants and seeds of *C. nitida* and *C. micrantha*, yielding grey bark. The plants were also destroyed by the heat of the Red Sea, and when they reached Bombay last December, they were in a hopeless condition. The seeds were forwarded to the Government gardens at Ootacamund, and at once sown.

The Ecuador Region.—The labors of Mr. Spruce, in Ecuador, have likewise been crowned with complete success; and his

* In the "Bombay Times and Standard" November 30th, 1860.

† Namely C. calisaya (var. vera), C. calisaya (var β josephiana), C. calisaya (var. moroda), C. ovata (var. communis) C. ovata (var. β rufinervis), C. micrantha.

‡ I was prevented from procuring seeds last August, after my collection of plants was completed, through the obstructions put in my way by the Peruvian authorities to hinder my return to the forests.

very able and interesting report* is evidence of the zeal, perseverance, and ability with which he has performed the duty entrusted to him. A large parcel of seeds of the red bark species has already arrived in Bombay, and been transmitted to Ootacamund; and Mr. Spruce has also collected 15 Wardian cases full of young plants, which, however, have not yet arrived.† Severe illness prevented him from also procuring plants and seeds of the *C. condaminea* during the year 1860, but I have no doubt that he will succeed in doing so in the ensuing season, if his health will permit it.

Success in South America.—Thus it will be seen that the arduous labors of all those who have been engaged in the important service of collecting these valuable plants, were completely successful, and quite equalled the most sanguine expectations that could have been entertained, so far as the duties of collection in South America were concerned. The conveyance to India entailed difficulties and dangers to the plants which it was not possible entirely to surmount. In an enterprise of such great importance, and surrounded at every step by so many dangers, more than one disappointment was of course anticipated, and precautions were accordingly taken so as to render eventual failure as nearly impossible as any human enterprise can be.

Precautions to ensure final success—In the event of the loss of all the plants of *C. calisaya*, and of all the seeds of *C. nitida*, *C. micrantha*, and *C. succirubra* which have already arrived in India, there is a depôt at Kew of other plants of *C. calisaya*, and of seeds of the other species, which are germinating, and coming up in great numbers. Other supplies of seeds have also been sent to Ceylon, as well as to Trinidad and Jamaica; and finally additional remittances can be procured from Mr. Spruce in Ecuador, as well as from correspondents of my own in Southern Peru.

Present prospects and expense of the undertaking.—Such is the very promising appearance of this interesting experiment, pre-

* Published in the Madras Times, of January 10th, 1861.

† *Note by Dr. Birdwood.*—These plants arrived on 28th March, and were forwarded on 30th idem to the Neilgherries, *viâ* Calicut, and are reported to be thriving most satisfactorily.

senting, as it does, an almost certain prospect of ultimate success; and it is not a little satisfactory that, considering the nature of the service, and its vast importance, it has been quite the reverse of expensive. The Dutch Government, I am told, on the authority of the Gardener's Chronicle, expended the sum of £10,000 on the single expedition of M. Hasskarl, to procure one species of cinchona, in one particular locality; while the present experiment, including all the expenses connected with three distinct enterprizes to widely separated regions, will cost under £ 4,000. Surely this is a small sum, to secure a certain and cheap supply of a drug which now costs the Government £ 50,000 a year for India alone.

The Cinchona forests in South America.—Having now given some account of the causes which have made this measure so important, of the previous attempts to introduce the cinchona, of the measures which I adopted for performing the service entrusted to me, and of the present prospects of the experiment, I will proceed to give an account of the forests in South America where the cinchonas grow, and of the results of my examination of some of the hill districts of the Indian peninsula, with a view to ascertaining their suitability as sites for the future cultivation of cinchona plants.

Extent of the Cinchona forests.—The forests on the Eastern declivities of the Andes, for a distance of upwards of 700 leagues,—from 19° S. Latitude, where in 1846 Dr. Weddell discovered the species which he named *C. australis*, to the snowy range of Santa Martha in 11° N.,—are the native region of the cinchona plants.

C. calisaya forests.—Commencing from the South, the forests of Bolivia and of Caravaya in Peru, on the Eastern slopes of the Andes, in a belt from 4,000 to 6,000 feet (according to my own observations) above the sea, are the homes of the *C. calisaya*, long considered the most valuable species of Cinchona. The formation of this region consists entirely of lower silurian rocks, clay slates with veins of highly auriferous quartz. The *Calisaya* region may be divided into two distinct belts, namely the lofty *Pajonales* or meadows interspersed with thickets, and the *Montanas* or dense forests which succeed at a lower elevation.

1. *The Pajonales* are long spurs running out from the snowy range of the Andes to the North and East, until they gradually subside into the vast forest-covered plains. Their sides are generally covered with dense forest, while the summits of the ridges are clothed with rich pasture land, interspersed with small thickets in the ravines and gullies. The grass is a *Stipa* growing in large stiff bunches, dotted here and there with a little white lily ; and the flora of the thickets consists of *melastomas, tree ferns, andromedas, palms, pentstemons, incense trees, Cinchona caravayensis* which yields no alkaloid, and the shrubby variety of *C. calisaya*, named by Weddell β *josephiana** which abounds, and is equally valuable with the larger variety. In this region there is almost constant rain for six months in the year, while continual mists and showers keep the vegetation constantly wet during the remaining six. In the months of April and May, equivalent to October and November in India, the temperature ranged between 69° and 53° Fahr.

2. *The Montana* or lower forests, in the ravine where my collection was made, rest on a yellow clay slate, traversed by veins of auriferous quartz.† They clothe the hills from the banks of the river Tambopata to the summits of the mountain peaks, and contain, besides India rubber, and other forest trees of gigantic size, numerous *palms*, innumerable *ferns*, the *mimosa* bearing the paccay fruit, *urticas, erithoxylons, melastomas*, and an immense variety of cinchonaceous trees. From September to April there is almost constant rain ; May is a showery month ; and June, July, and August are dry with occasional showers. In May the temperature ranged from 62° to 75° Fahr., and the average annual temperature is about 65.°

Forests of the Grey and Crown barks.—Beyond the Peruvian province of Caravaya, to the North and East, although exactly

* This variety of C. Calisaya was named Josephiana by Weddell, in honor of the French botanist Joseph de Jussieu, who came out to South America with M. La Condamine in 1735. In 1739 he examined the forests of the C. Condaminea near Loxa ; and afterwards explored those of Upper Peru ; but in 1750 he was robbed of all his valuable collections by a servant, when on his way home by way of Buenos Ayres.

† The ravine of Tambopata, in the Peruvian province of Caravaya, near the frontier of Bolivia.

the same silurian formation, long continues to be the basis of the soil, and though there is the same climate at similar elevations, the *C. calisaya*, and indeed all the valuable species, entirely cease to appear. Such useless species as the *C. pubescens*, *C. amygdalifolia*, and *C. scrobiculata* alone appear on the Eastern declivities of the Andes, between Caravaya and the forests of Huanuco in 10° S., when the species yielding grey bark commence.* Further North, and nearly up to 5° S., the Cinchonas in the forests round Jaen de Bracamoras, (and which crown the precipices bordering on the famous strait of Manseriche, in the river Maranon) such as *C. humboldtii*, again become worthless, until the famous forests of Loxa are reached,—the region of the *C. condaminea*. The Loxa forests are from 6,000 to 8,000 feet above the sea, in a mean temperature of from 60° to 65° Fahr., and on a formation of gneiss and micaceous schist. In this temperate cinchona region, grow *palms*, *tree ferns*, *Liliaceæ*, *Ericaceæ*, *melastomas* with a purple flower, *astronias*, arborescent *passifloras*, *bocconias*, *gunneras*, *thibaudias*, *cecropias*, *fuchsias*, gigantic climbers, beautiful *alstrœmerias*, *Aroideæ*, *myricas*, and many species of *Symplocos*, besides a variety of cinchonaceous plants.

Forests of the red bark.—We now come to the forests on the Eastern slope of Chimborazo, where the species yielding red bark, the value of which is now considered to be equal to that of *C. calisaya*, first appears. I am unable, at present, to give any details respecting the flora and climate of this important region, but Mr. Spruce promises to supply us with a full report on this interesting subject shortly. I can only now state that the forests are upwards of 4,000 feet above the sea, with a temperature from June to September between 74° and 60°, and that the finest cinchona trees grow in a stratum of yellow or reddish marl of great thickness.

Northern limits of Cinchona forests.—Proceeding northward along the eastern declivities of the Andes, we find that the *Cinchonæ* disappear in the elevated plains of Riobamba, Quito, and Pasto, up to Almaguer, but re-appear again in abundance

* The forests of the provinces of Cuzco, Ayacucho, and Farma (the two former of which I visited in 1853) intervene between Caravaya and Huanuco.

north of that place, which is in Lat. 1° 51′ 57″ N. and continue without interruption, by the Andes of Quindio, to the mountains of Merida and Santa Martha in 11° N.

In concluding this brief sketch of the nature of the cinchona forests, I shall quote the most correct and graphic description of a locality favorable for the growth of cinchonas that I have yet met with, by Dr. Karsten, which is translated in Mr. Howard's most valuable work "*Nueva Quinologia*" *No.* 2.

Dr. Karsten's description of a locality favorable for Cinchonas. —"The cinchonæ which are rich in alkaloids inhabit the peculiar cloudy region of the Andes in which, during the rainy season, which continues for nine months in the year, a steady rain is only interrupted during the day by short gleams of sunshine, interchanging with clouds and mist; whilst in that part of the year which answers to our winter, cold nights, in which the temperature of the air descends to freezing point, are followed by days in which the rays of the sun, piercing here and there, through the thick clouds, raise the temperature to 77° Fahr.; whilst the leaves are kept almost constantly bedewed by the continual mists."

"Ravines, stretching upwards into the grass-covered region and filled with forest vegetation, are the channels by which the streams of air ascend, when the mid-day sun warms the leafy covering of the mountain side. Here the mist first begins to form, when the strata of warm air, containing much aqueous vapour, mix with the colder atmospheric currents descending from the icy summits, and there ensues a frequently repeated alternation of thick mist, which entirely bedews the surface of the plants, and of warm sunbeams which dry and warm the moistened leaves. This lasts till late in the afternoon, when misty clouds overspread the whole district, until they are condensed by the cold of the night, to be again raised into vapour by the morning sun. This is the peculiar climate of those cinchonæ which are rich in organic bases."

Sudden disappearance of Cinchonas, and well defined limits of species.—The snowy range of Santa Martha, in Lat. 11° N. has been mentioned as the extreme northern limit of cinchonas;

but it is very remarkable that some of the mountains of Cumana, in Venezuela, such as Fumiriguiri, having elevations of 4,000 to 5,000 feet, and possessing a favorable cool climate, are destitute of cinchona plants, though close to the mountains where they abound. The only apparent reason for this is, that a belt of low-land intervenes, and seems to break the chain which is continuous from 19° S. to 11° N. The same may be said of the forests on the high table-land of Jalapa in Mexico, which possess a climate and elevations exactly similar to those of Upper Peru ; and where the aspect of the land, the tree ferns, arborescent melastomaceæ, cool temperature, and humidity, would lead one to expect the presence of cinchona ; yet this is not the case. This may arise from the almost entire disappearance of the Cordillera of the Andes, near the gulf of Cupica, and the isthmus of Panama, being below the level of the cinchona region, the continuous chain is thus again broken. This sudden disappearance of cinchona at a particular point, although there are localities suited for their growth, at no great distance ; and the distinct and well-defined limits which confine the different species to particular districts, without apparent cause, are noticeable facts connected with the cinchona trees ; and are, I believe, not applicable to the plants which are associated with them.

Comparison between the Cordilleras, and the Western Ghauts.—Let us now compare the cinchona region of South America with that of the western ghauts in the peninsula of India ; and, with the data given above, endeavour to form a judgment as to whether localities sufficiently resembling their native habitat, can be found at so vast a distance.

Climatic and other conditions necessary for the growth of Cinchonas.—It will have been gathered from what I have said respecting the South American Cinchona region, that the conditions most favorable for the production of quinine in Cinchona plants are those of continuous vegetation ; with a mean temperature of from 60° to 70°, varying according to the species ; elevations of from 4,000 to 8,000 feet ; and a constant supply of moisture. It is the latter essential requisite which is most difficult to find in India, and which confines the eligible

sites for Cinchona plantations within the narrow limits of the region which enjoys the benefit of both monsoons.

Site chosen for a plantation in the Neilgherries.—The first site which has been selected, is in the Neilgherry hills, at the highest available elevation that could be found, South of the Himalayas. It is a wooded ravine at the back of the range of hills which rises behind the Government gardens at Ootacamund, and which entirely protects it from the West winds; whilst another high ridge completely screens it from the East. It is 7,450 feet above the level of the sea, and, from its sheltered position, is warmer by several degrees, than Ootacamund. Like the thickets where the *Cinchonæ* abound on the *Pajonales* of Caravaya, in Peru, it is surrounded by steep grassy slopes, with an analagous vegetation. Thus *osbeckias* and *sonerilas* take the place of the purple *Melastoma*, and tree *rhododendrons* and *gaultherias*, that of the Peruvian *Andromeda*. The vegetation of the interior of the ravine also resembles, to some extent, that of the thickets on the Peruvian pajonales. In order to give a general idea of the flora of this locality, I here subjoin a list of genera of plants growing in the Neilgherry ravine, which has now been selected.

Amongst Cinchonaceous plants are *Hedyotis*, *Lasianthus*, *Coffea*, *Canthium*, *Grumilea*, *Psychotria*; and the other genera are *Vaccinium*, *Myrsine*, *Symplocos*, *Ilex*, *Eugenia*, *Myrtus*, *Lonicera*, *Jasminum*, *Michelia*, *Osbeckia*, *Sonerila*, *Solanum*, *Sapota*, *Isonandra*, *Passiflora*, *Viburnum*, *Lobelia*, *Rubia*, *Acanthus*, *Piper*, *Cinnamomum*, *Convolvulus*, *Begonia*, *orchids*, and *ferns*. Outside the thicket, on the grassy slopes, are tree *rhododendrons*, *Gaultheria*, *Galium*, *Berberis*, *Lycopodia*, *brake ferns*, *lilies*, and numerous small wild flowers.

The temperature appears to be almost identical with that of the Peruvian *payjonales*; and the spot receives a moderate supply of rain and mist, during both monsoons. It is true that this wooded ravine is more elevated, by nearly 1,500 feet, than any point in Caravaya where I found the *C. calisaya* growing; but Ootacamund is more than two degrees nearer the Equator; and the temperature of the two places appears to be almost identical. I am of opinion that this side will prove suitable for

the growth of those species and varieties of Cinchonæ which prefer lofty situations—from 6,000 to 8,000 feet above the sea.—such as *C. lancifolia*, *C. condaminea*, *C. nitida*, and the *Josephiana* or shrubby variety of *C. calisaya*. It will be found to resemble the peculiarly favorable aspect described by Dr. Carsten, and quoted above.*

Second site chosen in the Neilgherries.—For the cultivation of the other valuable species, it was necessary to find a second locality at a somewhat lower elevation, and where there would be a much greater extent of land available for the plantation. Such a site was found on the declivitous, forest-covered slopes of the northern face of the Neilgherry hills, overlooking the table-land of Wynaad; and I have seen no part of the hill districts which appeared to me, so nearly to resemble the native habitat of the Cinchonas. The site is close to the traveller's bungalow at Neddiwathum, near the crest of the ghaut, on the road leading from Ootacamund to Wanantoddy. The forest covers a declivitous slope, at an elevation of about 5,000 feet, and extends to the verge of the steep descent into the table-land of Wynaad. There is a good supply of water in the forest; and the soil is rich and tolerably deep, its base being a mixture of syenite and laterite in rather curious combination. In this forest, amongst other plants, I found the *Hymenodictyon excelsum* (called by Dr. Roxburgh, *Cinchona excelsa*, but excluded from the list of *Cinchonæ* by Dr. Weddell), an *Andromeda*, *wild yam*, *cinnamon*, *pepper*, *coffee*, *wild ginger*, an *Osbeckia* (*Melastomaceæ*) with a purple flower, and numerous *orchids* and *ferns*. Moss in great quantities was hanging from the branches and trunks of the trees, a sure sign of much moisture. This jungle is within the limits of the region which receives both monsoons. Though protected to some extent from the S. W., it receives a full share of the monsoon during the summer, and is also refreshed by the N. E. Moonson, coming across Mysore, from October to December. During the remaining months it is not without mists and heavy dews in the nights, until the S.W. moonson again commences in May. Eventually the plantation

* In South America, and specially in Huanuco, the higher and colder the place of growth, the more value is attached to the bark.

might be extended for a considerable distance to the East and South, at the same elevation, to the falls of the Moyaar, a tributary of the Cauvery; and even further still in the direction of Kalhutty.

The road which passes by Neddiwathum leads to the coffee estates of Wynaad, of which there are now upwards of forty belonging to European settlers; thus the planters will often pass the Cinchona plantation, and, when its success is secured, it is to be hoped that some of them will undertake the cultivation in the forest lands immediately above the line of their own coffee estates. Unfortunately the coffee plantations in the Neilgherries are all on the Southern side, near Coonoor and Kotagherry; which is too dry for the *Cinchonæ*, being outside the region of the S. W. Monsoon. The *C. succirubra* yielding red bark, *C. calisaya*, and *C. micrantha* may all be cultivated in the forest which has been selected at Neddiwattum.

Site selected for a Cinchona plantation in Coorg.—Next to the sites selected in the Neilgherries, the mountainous district of Coorg appears better adapted for the growth of the cinchona plant, than any other part of the western ghauts. Tadi Andamol, the highest peak of Coorg, is 5,780 feet, and its capital, Mercara, 4,500 feet above the sea. During January, February, and March scarcely any rain falls, but the valleys are seldom without moisture; and, during my visit in January, heavy dews were frequent in the morning and evening, and at sunrise there were always long streaks of low lying clouds resting on the sides of the ravines. At this season the belts of jungle, both on the Mysore and Malabar sides of Coorg are scorched up with excessive dryness, (a condition never known in the South American forests with which I am acquainted,) but this was not so much the case in the loftier parts of the Coorg district. In April and May there are frequent showers; from June to August the rain comes down in torrents; in September and October there are showers; in November Coorg receives rain from the N. E. monsoon in small quantities, and December is foggy. The fall of rain on the Western side of Coorg, the only part suitable for *Cinchonæ*, averages 150 inches. The mean of the thermometer at Mercara, in 1836, during the hottest month was 78°, and

during the coldest 68°; the average temperature being about 65°.

I examined the country in the neighbourhood of Mercara, and found a locality, to which I had been directed by Dr. Macpherson, which is well suited for a cinchona plantation. It is four miles from Mercara, by the side of the road to Mangalore. Its elevation must be a little over 4,000 feet, and the forest, about a mile long, extends, in breadth from the road, down the steep sides of a ravine to the valley at the bottom, which is bare of trees. It contains many tall trees, though not growing close, and the underwood is very dense, consisting of five kinds of *ferns*, a *Solanum*, a *Lobelia*, &c. There were also *cinnamon*, *hymenodictyons*, *tree ferns*, and *Melastomaceæ;* and the general character of the flora appeared suitable for the growth of cinchonæ. In this, the dryest season, I found two small streams trickling through the underwood. Further down, the Mangalore ghaut there are several flourishing coffee plantations, and when a Government cinchona nursery is successfully established in their neighbourhood, the planters may also undertake the cultivation. There are probably many other sides equally suitable for the growth of cinchona, in Coorg, but none so conveniently situated as regards Mercara. Labour, as is also the case on the Neilgherries, is chiefly procured from Mysore, the coolies coming up after their own work is done.

The Pulney Hills.—In the Madura district, the Pulney or Varragherry hills, like the Neilgherry hills further North, branch out in an Easterly direction from the main line of the Western Ghauts. United to a portion of the Anamallay range at their Western end, they stretch out into the Madura plains for a distance of 50 miles, and average a breadth of 15 to 20. They are divided into two parts—a lower series of hill and dale to the Eastward averaging a height of 4000 feet, where there is a great deal of forest, some cultivation, and several villages inhabited by people of the Vellaler caste; and a loftier region to the Westward averaging 6000 feet, with mountain peaks, the highest of which—Permanallie—attains an elevation of 7500 feet. The formation consists of gneiss, traversed by veins of felspar, and the soil in the Eastern part is a light reddish loam, yielding

crops of garlic, mustard, two kinds of millet, besides groves of plantains; and lately the villagers have formed several small coffee gardens. In the Western and loftier part, the soil is very poor, being a heavy black peat, several feet thick, with a yellow, stiff clay as a sub-soil. The rains on the Neilgherry hills have the effect of mixing the decaying grass with the decomposed rock, and a rich soil is thus formed; but on the Pulneys this does not appear to be the case, the one becoming a black peat, the other a stiff clayey sub-soil. These remarks apply to the interior valleys; but on the outer slopes, looking over the plains of Madura, there is good soil in places, and magnificent forests at the foot of a perpendicular wall of gneiss, which forms the Southern ridge of the Pulneys. There are also fine forests in the sheltered ravines, in which I observed trees of the following genera: *Michelia, Myrsine, Millingtonia, Cinnamomum, Dodonæa, Monocera, Symplocos, Bignonia, Crotalaria, Passiflora, Osbeckia, Jasminum,* besides a variety of cinchonaceous plants, such as *Hedyotis, Lasianthus, Canthuim,* and *Hymenodictyon.* Tree ferns abound near streams; and, like the Neilgherries, the grassy plains are dotted with *rhododendrons, gaultherias, lobelias, hypericums* and *ferns.* I was told that during the season of the S. W. Monsoon the Pulneys only receive passing showers, and in corroboration of this, I missed the *Berberis Mahonia,* a plant which, on the Neilgherries, is never found beyond the range of the S. W. Monsoon. The Pulneys, however, receive the full benefit of the Monsoon from the N. E.

There are several damp, well-wooded ravines near the settlement of Kodakarnel, where the species of *Cinchonæ,* which prefer great altitudes, might be established. When these plants are thoroughly rooted in the Neilgherries, a few might advantageously be sent to the Pulney hills under the care of the gardener employed by the Collector of Madura,—Mr. McIvor having previously selected a suitable site. As the villagers have lately introduced the coffee plant, it is not improbable that they might also be induced to undertake the cultivation of the plant yielding quinine, of the value of which they are well acquainted.

The Anamallay Hills.—The Anamallay hills probably possess several localities suitable for the growth of Cinchonæ, but

being very feverish, and no European being yet established on them, it will probably be many years before they could be made available.

The Shervaroy Hills.—The Shervaroy Hills, in the Salem district, only attain a height of 3000 feet; and, being quite out of range of the S. W. Monsoon, they are both too low and too dry for the growth of the Cinchona plant.

Hills near Courtallum.—In Tinnevelly, the Courtallum hills enjoy the full benefit of both monsoons, but the highest waterfall near Courtallum is only 2000 feet above the sea. Localities, however, may hereafter be found between Tinnevelly and Travancore, with an elevation of 3000 to 4000 feet, where the *C. micrantha*, and even the *C. succirubra* might thrive.

Mahableshwur Hills.—The only part of the Western Ghauts within the Bombay Presidency which attains an elevation sufficient for the growth of *Cinchonæ*, are the Mahableshwur hills, the highest part of which is 4700 feet above the sea, in latitude 18° N. These hills are composed almost entirely of laterite, overlying the basalt of the Deccan, and the soil is exceedingly poor and shallow. The average temperature of the hottest month is 73°, of the coldest 62°, average mean temperature 65½°; but the climate in every other respect is most unfavourable. From October to the end of April, scarcely a drop of rain falls, and everything is dried up, the Mahableshwur hills receiving no portion whatever of the N. E. Monsoon; too wide an extent of land intervening between them and the Bay of Bengal. In May there are showers, and from June to September there is an unceasing deluge of rain,—the fall being estimated at from 250 to 300 inches. The most essential requirement for the growth of cinchonæ is a continuous supply of moisture; and in a climate where, for upwards of six months in the year, they would be exposed to excessive dryness, they certainly would not live. In addition to these climatic obstacles, there is a great want of forest trees in the jungles, which would supply a sufficient amount of shade; the vegetation of the scanty thickets consisting chiefly of such shrubs and small trees as *memecylons, jasmines, Gnidia eriocephala, randias, indigoferas, willows* near streams, a small

Crotalaria, *eugenias*, with an undergrowth of *solanums*, *ophelia multiflora*, *ferns*, and *curcumas*. I visited both Coorg and Mahableshwur in the driest and most unfavourable period of the year; but the advantage, both as regards vegetation and moisture, was incomparably in favour of Coorg: indeed, I should say that there was no part of the Western Ghauts, of similar elevation, so entirely unsuited for the growth of cinchonæ as the Mahableshwur hills.

Paunchgunny.—Ten miles to the Eastward of the station at Mahableshwur, and immediately overlooking the valley of the Krishna, there is a place called Paunchgunny. It is under 4000 feet above the sea, entirely exposed to the cold East winds during the dry months, the surrounding hills are destitute of jungle affording suitable shade, and altogether, it is the last place where cinchona plants would be likely to thrive. I regret this, because at Paunchgunny there is a small experimental farm belonging to a retired apothecary of the late Honorable Company's Service. Application has been made for some plants, and no doubt all possible care and attention would have been bestowed upon them.

Khasia Hills, Penang, and Tennasserim.—The cinchona plant, in its native forests, is entirely confined to the tropics, and it seems likely that the greater variation of temperature in extra-tropical regions would render any part of the Himalayan range unsuitable for its culture. Nevertheless, under cultivation, it may be found possible to extend the area of the cinchona region; and the Khasia hills in the Bengal Presidency, where the necessary elevations can be obtained,* may hereafter supply another site for a plantation; though, in the first instance, it would be imprudent to attempt the experiment in any other regions than those which most nearly resemble the cinchona forests of South America. In the island of Penang, and in the Tennasserim provinces, the necessary climate and elevation may also be found.

* Dr. Royle recommended, as well as the Neilgherries, the mountains of Chittagong and Silhet; adding that, on Chirrapoorjee, in Lat. 25°, there was an elevation of 4286 feet.—*Himalayan Botany I.*, *p.* 240.

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Ceylon.—On the whole, it will probably be found that the hill country of Neuerellia, in Ceylon, which possesses the necessary elevation, and is within the region of both monsoons, will be found as good a locality as any which I have described in the peninsula of India; and I am glad to hear from Mr. Thwaites that many of the coffee planters are extremely desirous of trying the cultivation of cinchonas on their estates. Mr. Thwaites has received some seeds of *C. micrantha* from Kew, which have not germinated; and there is little hope that those sent him by Mr. McIvor will be more successful. A good supply of Mr. Spruce's seeds will, however, have reached Ceylon by this time.

Operations for the future which are recommended.—In conclusion, it will be well to add some observations respecting the measures it will be advisable to adopt in conducting the future operations connected with this most important experiment, the success of which will establish, as a native of India, the plant yielding the most valuable drug, as regards tropical countries, that is known in medicine; the supply of which now costs the Government of India upwards of £ 50,000 a year.

I have recommended that the experiment should, in the first place, and until the propagation of plants by cuttings has rendered success certain, be confined to the two sites already selected near the gardens at Ootacamund and at Neddiwatum; and that its management should be entrusted to Mr. McIvor, the Superintendent of Government Gardens at Ootacamund, whose zeal, intelligence, experience as a gardener, and knowledge on this special subject, probably exceeds that of any other person to be found in India.

There is every reason to hope that, before the close of this year, Mr. McIvor will have in the green-house at Ootacamund a goodly supply of healthy young plants, raised from plants and seedlings sent from Kew, and from Mr. Spruce's seeds, of the species *C. calisaya*, *C. succirubra*, *C. micrantha*, *C. condaminea*, and *C. nitida*; and it should be remembered that, as regards the *C. calisaya* especially, if only one or two good healthy plants could once be established at Ootacamund, it would be easy to propagate them, in two or three years, to

almost any extent. The Madras Government has already made the necessary grant for expenses connected with clearing and planting the site near the gardens, and a similar grant should be made for the proposed plantation at Neddiwatum. In order to reduce the expense as much as possible, Mr. McIvor has made an excellent suggestion, which has been approved,—namely, to plant the spaces between the cinchona trees with peppermint, the essence to be prepared and sold, so as to meet the necessary outlay in keeping up the plantations in the interval that must elapse before the cinchona trees can become profitable. I have recommended, in addition, that, as soon as the plantations in the Neilgherries are thoroughly established, a third plantation should be formed in the forest already described, in Coorg, on the Mangalore road, in the vicinity of the coffee estates; and also that some plants should be established in a carefully selected site on the Pulney hills.

Method of cultivation recommended.—The large forest trees should at first be left standing in the plantations, to protect the plants from the sun, the gales of wind, and heavy rains. When the cinchona becomes a cultivated plant, I believe that it will be found most profitable to grow it in its shrubby form, that more bark will be obtained from the shrubs than from trees occupying the same space of ground, and that the value of the bark will not deteriorate. Mr. Howard, the great quinine manufacturer, informs me that, though the large bark from trees is preferred, and yields rather the most quinine, the bark from small branches also commands a good price. Shrubs would undoubtedly suffer little from the bark being removed from their smaller branches, while large trees would never recover from the loss of the bark of their trunks: indeed, such a system would resemble that which has proved so destructive to the cinchona trees in South America.

It appears to me that cinchonas should be cultivated in the same way as coffee and cinnamon, and not be allowed to run up as trees. Cinnamon is the only other plant which is cultivated for its bark, excepting, of course, those which are grown for their fibre; and I therefore here insert a few particulars respecting cinnamon culture in Ceylon.

Cinnamon culture.—For the cinnamon gardens, the young shoots are peeled twice during the year, at a particular period of growth, when the bark comes off readily. This time is known at once by the peelers from the appearance of the young shoots, and the process of peeling is then a very expeditious one with practised hands. Young plants are raised from seeds in nurseries, and planted six feet apart, when they are a foot or 18 inches long. They will commonly bear peeling in 3 or 4 years after being transplanted, if in a favourable locality, and properly attended to. The roots are earthed up frequently to keep the soil loose and free from weeds.

Manufacture of quinine.—From the Government plantations it may be expected that a considerable quantity of quinine-yielding bark will eventually be collected;* and, though the process of extracting quinine may be too difficult, and require too much skill, as well as expensive materials difficult of transit, to give any prospect of its being carried on *in situ*, there can be no reason why a manufactory should not be established in the Presidency town, so as to avoid the costly necessity of sending the bark to England.

Prospects of the spread of cultivation among coffee planters.—I think it likely that as soon as the coffee planters of Wynaad, Coorg, and Ceylon know that the Government experiment has been successful, they will be willing to undertake the cultivation of cinchona plants on their own account; and, for this reason, it is an advantage that the Government cinchona nurseries should be in the vicinity of the coffee estates. This valuable product, which has never yet been cultivated in South America, would then soon be as important an addition to the

* One or two lbs. of bark is quite sufficient for an analysis. The taste of the bark by one who, by use, has learnt to distinguish it, is a good test of the presence of *quina*.

Pereira says that if the bark be powdered, then shaken with ether, and afterwards successively treated with chlorine and ammonia, the liquid will assume a green color if the slightest trace of *quina* be present.—*Mat. Med. II. pt. ii. p.* 119.

But ether is awkward stuff to carry about, and materials for making chlorine rather heavy.

Another process of testing the presence of *quina*, by M. Guiliemond, of Lyons, is given in the Pharmaceutical Journal for October 1859.

products of the Indian hills, in a commercial point of view, as coffee has already become.

Among natives.—A great number of people have an impression that the natives can with difficulty be induced to undertake the cultivation of any new plant to which they have not been accustomed: but this is certainly erroneous as regards Southern India. Not to mention the potatoe, maize, tobacco, and capsicums which are originally natives of America, and are now generally cultivated in India, it is a fact that in Wynaad upwards of 2000 acres are taken up for coffee cultivation by the natives; in Coorg, where coffee was only introduced about six years ago, I scarcely saw a single hut to which a small coffee garden was not attached, and the villagers in the Pulney hills have also commenced its cultivation. The extent too, to which the cassava, only lately introduced, is now cultivated in Travancore, is quite remarkable. There is every reason, then, to suppose that the natives will be equally ready to cultivate a plant yielding quinine, the value of which is so well known to them.

South America owes India something for the products she has received from the Old World.—In obtaining plants and seeds of these valuable cinchonas, for introduction into India, the writer of this paper would certainly be the last person in the world to desire to do any injury to South America,—a continent in the welfare of which he has for years taken the deepest interest. The demand for quinine will always supply a market for the barks of South America; and I believe that the cultivation of the plant in India will bring quinine within the reach of a vast number of people who are now excluded from its use, will render the supply cheaper and more abundant, without in any way injuring the South American trade. It should ever be remembered that South America owes to India the staple food of millions of her people—namely, the plantain; and to the Old World most of her valuable products—wheat, barley, sugar-cane, the vine, rice, the olive, coffee, sheep, cattle, and horses. The people of Peru and Bolivia should not, then, through a feeling of petty jealousy, grudge to India a product which is so essentially necessary to her welfare. A few wretched officials may do so; but the more liberal and enlightened Peruvians, and

there are many such, have shown themselves willing and ready to promote a friendly interchange of the products of the New and Old Worlds. Unfortunately, the latter class are in a minority, and have no voice in the conduct of the present Republican Governments.

Note.—Price of Barks and Quinine in London, 1860 :—

	s. *d.*		*s.* *d.*		
Red Bark	3 6	to	7 0	*per*	*lb.*
Calisaya Bark	2 8	to	5 0	,,	,,
Grey Bark	1 6	to	2 6	,,	,,
Quinine	8 6 per oz.				
Calisaya bark, average produce of quinine .	2·6 per cent.				
Red bark, best sort	2·65 per cent.				

Pereira Mat. Med.

Dr. Macpherson states that the plants in Java yield 5 per cent !

Great Britain imports 400,000 lbs of bark, 120,000 retained for home consumption. Export of Bolivian bark from the port of America in 1859—192,600 lbs.

I have not got the returns from the other South American ports by me. The bark ports are Arica, Jalay, Callas, Payta, Guayaguil, and Carthagena.

NOTE ON THE QUANTITY, DENSITY, AND REACTION OF THE URINE IN PERSONS RESIDENT IN BOMBAY.

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Presented, December 1860.

I HAVE been engaged for some time past, as opportunities have presented, in the attempt to determine the *quantity*, *density*, and *reaction* of the urine in persons resident in Bombay. Although my observations are neither so numerous nor so varied as might be desired, they may perhaps be usefully recorded. I was induced to take up this subject from a feeling which was shared by my predecessor in the chair of Clinical Medicine, that in the clinical examination of Native patients we have no accurate standard with which to compare morbid conditions of the urinary secretion.

The observations have been made and recorded by myself upon persons carefully selected, and whose statements I have taken every possible means to verify. Whenever there has been the least reason to suspect error or imposition, the observation has been at once set aside.

The investigation, simple as it may seem, has not been unattended with difficulty. My first observations were made upon Hospital servants who were selected for the purpose, and, as it was thought, fully impressed with the necessity of truthfulness. At the end of some weeks, it was discovered that one of the subjects of experiment had been in the habit of mixing water with his urine, so as to make up the quantity whenever, from forgetfulness, he had neglected to preserve a portion of it; whilst another, who at times had neglected to keep any of his urine, substituted that of one of the Patients in his ward. It was, therefore, determined to be content with fewer observations, and to restrict them for the most part to educated and intelligent persons upon whose statements reliance could be placed.

In regard to the reaction, some difficulty was at first experienced, by reason of the rapid decomposition of the urine; but, by paying much attention to the cleanliness of the vessels in which it was collected, the difficulty was removed.

The observations were made in the months of December 1858, January, October, November, and December 1859, August, September, and October 1860. The chief points of meteorological interest in these months bearing upon this inquiry, are shown in the following Table:—

Table 1.—Abstract of Meteorological observations supplied by the Bombay Observatory, extracted from the Mortuary Returns.

Date.	Means.			Date.	Means.		
	Barometer.	Thermometer.	Dewpoint.		Barometer.	Thermometer.	Dewpoint.
1858				1860			
December .	29·943	75·6	67·4	August....	29·728	81·8	77·9
1859				September .	29·718	80·2	77·9
January ..	29·933	74·7	66·6	October ..	29·785	83·6	79·0
October ..	·854	80·5	75·0				
November .	·831	84·4	70·5				
December .	·931	74·2	64·4				

The total number of persons upon whom observations were made was twenty-one, as follows:—European 1, Brahmins 6, Senoy 1, Parsees 6, Mussulman 1, Native Christians 3, and Mahrattas 3.

The total number of observations recorded is 124, viz:—

In Europeans	15
,, Brahmins	49
,, Senoys	16
,, Parsees	24
,, Mussulmans	2
,, Native Christians	9
,, Mahrattas	9
Total	124

Quantity.—The quantity of urine was determined for 24 hours, viz. from 6 A. M. until the same hour on the following day. At the hour first named, the urine which had been secreted during the night was passed and thrown away, and all that was secreted up to the same hour on the following day was preserved, and examined at 10 o'clock.

The maximum quantity of urine passed in 24 hours, including all castes, was 76 ounces; the minimum quantity 12 ounces; the average or mean 33 ounces. These quantities are, however, rather understated. 1*st*, because no great precautions were taken to prevent evaporation; 2*nd*, because allowance has not been made for waste, &c. If we estimate the mean loss, on these two accounts, at 3 ounces (and this would be rather above than below the mark), the mean daily average will be 36 ounces. The following Table will exhibit the maximum, minimum, and average quantities passed by different individuals:—

Nos.	Number of observations.	Maximum.	Minimum.	Average.
		ounces.	ounces.	ounces.
1	11	50	25½	37
2	11	76	48	58
3	7	59	24	36
4	12	40	22	34
5	3	34½	20	26
6	4	34½	21	28
7	4	28½	22½	25
8	4	24½	12½	20
9	2	42	29	35½
10	16	37	12	19½
11	4	37	33	40½
12	4	42	32	38
13	3	37	26	31
14	3	56	31	42
15	3	59	42	48
16	3	37	36	36
17	3	52	28	43
18	3	33	29	30
19	3	34	30	32
20	3	27	13	20
21	3	41	25	33

There is some difficulty in obtaining anything like a fixed standard with which to compare these observations. In England, Dr. Prout's estimate has, I believe, generally been adopted, viz. 32 ounces or 30 ounces in summer, 40 ounces in winter. This is, however, below the standard of other observers. Dalton, from observations upon his own person, stated the quantity passed in 24 hours as from 48½ to 51½ ounces. Dr. Routh, from 16 carefully recorded observations, assigned 35 ounces as the average quantity; whilst Dr. Thudichum, as the mean of 133 daily observations upon two individuals, has fixed the standard at from 60 to 68 ounces. Other observers have assigned quantities varying from 21 to 57 ounces. Thus the quantity given—

by	Rayer is	from	21 to 57	ounces.
,,	Carpenter	,,	30 to 40	,,
,,	Routh	,,	38	,,
,,	Haller	,,	49	,,
,,	Christison	,,	35	,,
,,	Lehmann	,,	42 to 49	,,
,,	Becquerel	,,	43 to 47	,,
,,	Haughton	,,	47	,,

Dr. Guy, from the examination of a considerable number of observations, thinks 41 ounces may be stated as a fair average. Dr. Thudichum's quantities are so much in excess of those of any other observer that they were probably dependent upon some peculiarity in regard to food, habits, or constitution. Excluding these, as well as the observations of Dr. Dalton, which were confined to his own person, the quantity, as determined by my examinations, corresponds very closely to that fixed by Drs. Routh and Christison, viz. 35 ounces.

The relation between the quantity of fluid drank and the quantity of urine passed was as follows:—20 persons passed 3,772 ounces of urine, and, during the same period, drank 6,286 ounces of fluid. This is, of course, exclusive of the quantity of fluid that might have been contained in their solid food. There is, on the whole, a correspondence, but by no means a close one, in regard to quantity between the amount of fluid and the excretion of urine. The maximum quantity of urine secreted in 24 hours, viz. 76 ounces, was passed by a Brahmin who drank during that day 96 ounces of fluid. The minimum

quantity, viz. 12 ounces, was also passed by a Brahmin who had only drank 28 ounces of fluid. Nevertheless, to this general statement there are many exceptions, due no doubt to difference of habits and atmospherical conditions. For example, one person, a native Christian, habitually drank between 90 and 100 ounces of fluid, yet he never passed more than 60, and sometimes as little as between 30 and 40 ounces of urine. This disproportion was traceable to his employment—that of a cook. A Mahratta, employed as a ward coolie, having little laborious occupation, and living for the greater part of the day in a cool ward in the Hospital, passed 41 ounces of urine, when he had only drank 48 ounces of fluid; whilst a young Brahmin student, taking very little exercise, on two occasions passed urine in excess of the quantity of fluid imbibed. It might be supposed that there was some error in recording the potations in this instance; but I feel confident there was none. The young man is, I believe, in the highest degree trustworthy, and the quantity of fluid said to have been taken is, as nearly as possible, the same as that used by other Brahmins, who are not engaged in active exercise.

Quantity of Urine in different Castes.—The data for determining the relative quantity of urine passed by members of different castes, are probably insufficient to justify the expression of any very decided opinion upon this point. So far as they go, it appears that the secretion of urine is most abundant in Native Christians and Hindoos, and the least abundant in Parsees and Europeans. Thus, in 9 observations in Native Christians, the average quantity was 47 ounces; in 61 observations in Hindoos it was 37 ounces; amongst Parsees and Europeans it was 34½ and 35 ounces respectively. With the view of adding some further information upon this point, I append Tables of successive observations upon different castes upon same days.

Table of three successive observations upon the quantity of Urine passed upon the same day by an European, a Brahmin, and Mahratta.

European	Maximum	39	ounces.
	Minimum	36	,,
	Mean	36½	,,

Brahmin	Maximum	15	ounces.
	Minimum	9	„
	Mean	12	„
Mahratta	Maximum	56	„
	Minimum	31	„
	Mean	42	„

Table of three successive observations upon the quantity of Urine passed upon the same day by a Native Christian, a Brahmin, and Mahratta.

Native Christian	Maximum	59	ounces.
	Minimum	42	„
	Mean	46	„
Brahmin	Maximum	37	„
	Minimum	36	„
	Mean	36½	„
Mahratta	Maximum	52	„
	Minimum	28	„
	Mean	43	„

Table of six observations showing the maximum, minimum, and mean quantity of Urine passed by different castes.

	Max. ounces.	Min. ounces.	Mean. ounces.
Europeans	40	36	37½
Hindoos	56	12	27
Parsees	35	33	25½
Native Christians	59	30	41

Density.—The density of the urine was ascertained by weighing a thousand grains in a specific gravity bottle. The urinometer was never used. All fractional quantities above and below a half were discarded.

The total number of observations made was 108, viz :—

Europeans 12, Hindoos 64, Parsees 21, Native Christians 9, Mussulmans 2; Total 108. Of the whole number the highest density observed was 1·030; this was in a European. The lowest density recorded was 1·009; this was in a Parsee.

The averages for different castes were as follows:— Europeans 1·026, Hindoos 1·016, Parsees 1·020, and Native Christians 1·020. The average for the whole number being 1·020.

Density with reference to quantity.—The density of the urine bore no very fixed proportion to the quantity. It is true that, in most instances, when the quantity exceeded 50 ounces, the specific gravity was comparatively low, as will appear from the following Table.

Table showing the Specific Gravity of the Urine when the quantity exceeded 50 *ounces.*

Quantity passed.	Specific Gravity.	Quantity passed.	Specific Gravity.
ounces.		ounces.	
52	1·010	59	1·018
53	1·018	59	1·009
55	1·016	59	1·016
56	1·009	60	1·015
57	1·011	60	1·011
57	1·011	76	1·012

But very low density has been noticed when the quantity of urine was small.

In one instance it was.. 1·010, the urine being 34 ounces.
,, two instances ...... 1·011, not more than 37 ,,
,, one instance ...... 1·013 .... 43 ,,
,, do ...... 1·013 .... 34 ,,

And, in like manner, the specific gravity has sometimes been high when the quantity of urine was large. The bearing of these facts upon the excretion of urine in connection with food and habits of life, is a point of great interest and importance; but into which I do not, at the present time, feel competent to enter.

Density with reference to food.—Dividing the whole number of persons upon whom observations were made, into two classes, viz. "*Flesh eaters*" and "*Flesh abstainers,*" it appears that the average density was for the former 1·022, and for the latter 1·016. We must be careful not to confound Natives, who abstain from the use of animal food, with vegetarians.

Reaction.—The reaction was generally acid; and in the few cases in which the urine was *alkaline*, or neutral, ammonia was found to be present. The acidity of the urine was well marked in all castes, including Brahmins.

TABLE *showing the Quantity of* URINE *passed by different Individuals*

	Quantity of Urine passed.	Quantity of Fluid drank.	General nature of Food.	Barometer.		Thermometer. In the air.		Thermometer. Wet bulb.		Electrometer Volta I.	Rain
	ozs.	ozs.		10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.	Max.	
No. 1.—W. S., Age 21, BRAHMIN, Student.											
1859 Dec. 4	42	59	Rice, Bread, Vegetables, Dhall, Milk, Ghee	29·917	29·831	69 2	82·0	64·6	68·2	6	
,, 6	44	50	Do.	·965	·837	67·2	80·6	64·2	70·0	4	
,, 7	35	55	Do.	·969	·876	66·0	79 8	62·0	68·6	15	
,, 9	47½	56	Do. with fruit	·974	·859	68·2	84·6	67·0	71·0	7	
,, 10	25½	55½	Do. no Vegetables..	·977	·896	70·9	80·4	69·5	73·4	1	
,, 11	32	47	Do. with Vegetables, and without fruit......			Sunday.					
,, 14	36	42½	Do.	30·005	·894	68·8	81·0	64·5	70·0	2	
,, 15	39½	67	Do.	·026	·928	68·0	80·8	65·5	72·0	4	
,, 16	50	62	Do. with addition of sugar..............	·017	·930	68·4	83·0	61·2	69·0	5	
,, 17	37½	51	Do.	·039	·920	72·5	82·7	66·1	73·5	6	
,, 18	25	48	Do. without sugar.			Sunday.					
Total..11											
Max......	50	67									
Min......	25½	42½									
Average ..	37	54									
No. 2.—B. A., Age 23, BRAHMIN, Student.											
1860 Jan. 5	62	79½	Bread, Rice, Dhall, Vegetables	30·280	29·843	64·0	79·6	61·0	67·0	..	
,, 6	74	93	Do.	·062	·890	65·8	77·2	62·6	69·5	9	
,, 7	46	80	Do.	29·987	·881	64·7	76·6	63·0	70·2	9	
,, 8	59	90	Do.			Sunday.					
,, 9	61	96	Do.	30·019	·890	65 5	79·9	63 0	71·4	9	
,, 10	53	84	Do.	29·986	·873	65·4	79.8	60·0	70·0	9	
,, 11	66	85	Do.	·971	·866	69·7	84·2	63·3	69·0	25	
,, 12	54	89	Do.	·991	·904	70·3	85·9	65·0	65·0	25	
,, 13	47	89	Do.	30·057	·933	68·3	83·6	64·5	70·0	30	
,, 14	76	96	Do.	·063	·943	67·8	78·9	64·9	69·5	15	
,, 15	48	83	Do.			Sunday.					
Total..11											
Max......	76	96									
Min......	48	79½									
Average ..	58	87									
No. 3.—P. M., Age 22, PARSEE, Student.											
1860 Jan. 21	36	46	Mutton, Vegetables, Bread, Ghee, Eggs,....	30·017	29·921	68·5	78·0	67·0	70·0	2	
,, 22	25	46	Do. with addition of Rice			Sunday.					
,, 24	24	27	Do.	·049	·936	60·0	76·0	52·0	62·5	18	
,, 25	30	61	Do. with addition of fish.	·038	·937	65·0	82·5	58·4	70·4	19	
,, 26	59	61	Do. without fish	·014	·917	66·2	80·0	63·0	71·0	20	
,, 27	42½	68	Do.	·004	·892	66·8	80·9	60·0	70·0	8	
,, 29	37	64	Do.			Sunday.					
Total.. 7											
Max	59	68									
Min......	24	27									
Average..	36	53									

with the general Nature of the Food taken and Quantity of Fluid drank.

	Quantity of Urine passed.	Quantity of fluid drank.	General nature of Food.	Barometer.		Thermometer. In the air.		Thermometer. Wet bulb.		Electrometer Volta I.	Rain.
	ozs.	ozs.		10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.	Max.	
No. 4.—A., Age 41, European, Sedentary.											
1859 Oct. 21	35	46	Bread, Fish, Eggs, Mutton, Cheese, Potatoes, Butter.	29·921	29·814	74·6	83·0	73·6	77·0	0	
,, 22	31	48	Do.	·916	·819	75·2	81·2	75·2	78·9	0	
,, 23	40	62	Do.			Sunday.					
,, 24	28½	46	Do.	·935	·820	76·4	85·0	75·2	78·0	0	
,, 30	40	60	Do.			Sunday.					
,, 31	29½	54	Do.	·977	·876	75·9	91·5	72·3	74·1	19	
Nov. 2	22½	46	Do.								
,, 5	37	46	Do.	·923	·840	74·0	85·7	72·0	73·0	15	
,, 6	31	54	Do.			Sunday.					
Dec. 17	37	60	Do.								
1860 Aug. 25	37	49	Do.	·839	·766	78·7	87·3	76·0	80·0	0	
,, 26	36	53	Do.	·889	·794	78·8	87·7	76·8	79·0	0	
Total 12											
Max	40	60									
Min......	22	46									
Average ..	34	52									
No. 5.—G. S., Age 19, Brahmin, Student.											
1859 Oct. 22	34½	28	Rice, Pulse, Ghee, Fruit, Vegetables, Milk	29·921	29·814	74·6	83·0	73·6	77·0	0	
,, 23	24	27	Do.			Sunday.					
,, 24	20	24	Do.	·935	·820	74·6	85·0	75·2	78·0	0	
Total 3											
Max	34½	28									
Min......	20	24									
Average ..	26	26									
No. 6.—M. B., Age 23, Parsee, Student.											
1859 Oct. 21	21	38	Wheaten and rice Bread, Meat, Fish, Vegetables.	29·921	29·814	74·6	83·0	73·6	77·0	0	
,, 22	33	66	Do.	·916	·819	75·2	81·2	75·2	78·9	0	
,, 24	26	53	Do.	·935	·820	76·4	85·0	75·2	78·0	0	
,, 25	34½	58	Do.	·947	·857	74·2	85·4	73·6	78·0	0	
Total 4											
Max	34½	66									
Min......	21	38									
Average ..	28	54									
No. 7.—C. H., Age 23, Parsee, Student.											
1859 Oct. 30	28½	37½	Wheaten and rice Bread, Vegetables, Rice, Dhall, Fish, Mutton, and Butter.			Sunday.					
,, 31	25	51	Do.	29·977	29·876	75·9	90·5	72·3	74·1	19	
Nov. 1	22½	54	Do. Sweetmeats ..	·963	·891	76·3	88·5	73·3	81·1	0	
,, 2	24½	49	Do.	·956	·829	75·2	85·2	74·6	77·0	8	
Total 4											
Max......	28½	54									
Min	22½	37½									
Average ..	25	47									

	Quantity of Urine passed.	Quantity of Fluid drank.	General nature of Food.	Barometer.		Thermometer. In the air.		Thermometer. Wet bulb.		Electrometer Volta I.	Rai[n]
	ozs.	ozs.		10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.	Max.	
			No. 8.—S. V., Age 21, BRAHMIN, Student.								
1859 Oct. 30	12½	37	Rice, Vegetables, Ghee, Dhall, Fish, Fruit, Milk.			Sunday.					
Nov. 1	24½	46	Do.	29·963	29·891	76·3	88·5	73·3	81·1	1	
„ 2	19	38	Do.	·956	·829	75·2	85·2	74·6	77·0	8	
„ 3	24½	44	Do.	·891	·786	74·3	84·6	72·3	75·0	0	
Total 4											
Max......	24½	46									
Min......	12½	37									
Average ..	20	41									
			No. 9.—A. K., Age 22, MUSSULMAN, Student.								
1859 Nov. 4	42	68	Bread, Rice, Beef, Butter, Ghee	29·887	29·791	73·6	84·8	71·3	76·0	21	
„ 5	29	51	Do.	·923	·840	74·0	85·7	72·0	73·0	15	
Total 2											
Max......	42	68									
Min......	29	51									
Average ..	35½	59									
			No. 10.—R., Age 24, SENOY, Hospital Assistant.								
1859 Nov. 10	17	38	Bread, Rice, Vegetables, Ghee, Milk	29·918	29·813	74·5	88·7	68·3	75·0	21	
„ 11	21	45	Do.	·962	·810	76·6	89·2	72·3	75·0	0	
„ 12	16	34	Do.	·916	·814	77·3	87·4	73·5	76·0	15	
„ 13	15	51	Do.			Sunday.					
„ 15	20½	40	Do.	·904	·807	76·0	86·8	72·6	76·0	9	
„ 16	29	36	Do.	·899	·791	74·1	84·9	71·5	74·0	4	
Dec. 14	19	30	Do.	30·005	·894	68·8	81·0	64·5	70·0	2	
„ 15	13	25	Do.	·026	·928	68·0	80·8	65·5	72·0	4	
„ 16	37	40	Do.	·017	·930	68·4	83·0	61·2	69·0	5	
„ 17	15	28	Do.	·039	·920	72·5	82·7	66·1	73·5	6	
„ 19	17	34	Do. with Fish	·011	·926	69·2	80·0	64·4	70·0	8	
„ 20	22	40	Do. without Fish ..	29·968	·848	66·0	79·8	64·2	68·0	17	
„ 21	25	46	Do.	·936	·876	65·4	80·4	68·4	68·4	6	
„ 22	14	24	Do.	·982	·878	69·2	80·6	65·0	71·6	15	
„ 24	21	28	Do.	30·047	·951	72·2	80·2	65·6	67·2	8	
1860 Aug. 18	12	22	Do.	29·685	·640	76·0	82·2	76·0	79·3	0	0·[illegible]
Total 16											
Max......	37	46									
Min......	12	22									
Average ..	19¼	33¾									
			No. 11.—S. A., Age 19, BRAHMIN.								
1859 Nov. 21	57	40	Rice, Dhall, Ghee, Fruit, Vegetables, Fish, Milk ..	29·871	29·775	75·2	89·4	71·0	76·8	10	
„ 22	33	39	Do.	·922	·817	76·5	88·9	71·5	76·8	0	
„ 23	41	42	Do.	·932	·806	74·6	86·9	68·0	75·5	10	
„ 24	34	30	Do.	·917	·789	79·4	86·2	70·0	77·0	0	
Total 4											
Max......	57	42									
Min......	33	30									
Average ..	40½	38									

	Quantity of Urine passed.	Quantity of Fluid drank.	General nature of Food.	Barometer,		Thermometer.				Electrometer Volta I.	Rain.
						In the air.		Wet bulb.			
	ozs.	ozs.		10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.	Max.	
No. 12.—A. H., Age—, BRAHMIN.											
1859.											
Nov. 25	42	..	....	29·867	29·767	76·5	88·2	69·3	76·0	8	
,, 28	36	..	....	·926	·818	75·5	88·5	69·2	74·5	0	
,, 30	42	..	....	·831	·723	72·8	83·8	69·3	72·5	7	
Dec. 1	32	..	....	·882	·803	74·6	80·8	70·0	71·2	4	
Total 4											
Max......	42										
Min......	32										
Average ..	38										
No. 13.—S. V., Age 21, BRAHMIN, Student.											
1859											
Nov. 30	31	..	....	29·831	29·723	72·8	83·8	69·3	72·5	7	
Dec. 1	26	..	....	·832	·803	74·6	80·8	70·0	71·2	4	
,, 2	37	..	....			Sunday.					
Total 3											
Max......	37										
Min......	26										
Average ..	31										
No. 14.—H., Age 25, MAHRATTA, Ward Boy.											
1859											
Aug. 25	41	48	Rice, Bread, Fish, Dhall, Milk, Vegetables......	29·839	29·766	78·7	87·3	76·0	80·0	0	
,, 26	31	50	Do.	·889	·794	78·8	87·7	76·8	79·0	0	
,, 27	56	48	Do.	·889	·792	79·0	86·1	76·5	80·0	0	
Total 3											
Max......	56	50									
Min......	31	48									
Average ..	42⅔	48⅔									
No. 15.—F., Age 23, CHRISTIAN, Cook.											
1859											
Sept. 1	59	88	Rice, Bread, Mutton, Dhall................	29·729	26·666	77·6	83·7	75·0	79·6	0	0·02
,, 2	42	96	Do.	·766	·720	78·5	85·6	76·8	80·0	0	
,, 3	43	114	Do.	·789	·713	78·2	80·1	75·6	77·1	0	0·05
Total 3											
Max......	59	114									
Min......	42	88									
Average ..	48	99½									
No. 16.—J., Age 24, BRAHMIN, Cook.											
1859											
Sept. 1	37	96	Rice, Dates, Sweetmeats, Vegetables, Ghee......	29·729	26·666	77·6	83·7	75·0	79·6	0	0·02
,,	37	96	Do.								
,,	36	96	Do.								
Total 3											
Max......	37	96									
Min......	36	96									
Average ..	36½	96									

	Quantity of Urine passed.	Quantity of Fluid drank.	General nature of Food.	Barometer.		Thermometer. In the air.		Thermometer. Wet bulb.		Electrometer Volta I.	Rain...
	ozs.	ozs.		10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.	Max.	
No. 17.—B., Age 30, Mahratta, Ward Boy.											
1860 Sept. 1	28	48	Rice, Vegetables, Fish, Potatoes	29·729	26·666	77·6	83·7	75·0	79·6	0	0·02
,, 2	49	64	Do.	·766	·720	78·5	85·6	76·8	80·0	0	
,, 3	52	72	Do.	·789	·713	78·2	80·1	75·6	77·1	0	0·05
Total 3											
Max......	52	72									
Min......	28	48									
Average ..	43	61⅓									
No. 18.—B. R., Age 30, Mahratta, Ward Boy.											
1860 Oct. 24	29	64	Rice, Bread, Vegetables, Fish	29·935	29·820	76·4	85·0	75·2	78·0	0	
,, 25	33	64	Do.	·947	·857	74·2	85·4	73·6	78·0	0	
,, 26	29	64	Do.	30·018	·915	77·1	84·1	76·0	78·0	0	
Total 3											
Max......	33	64									
Min......	29	64									
Average ..	30⅓	64									
No. 19.—M., Age 23, Christian, Cook.											
1860 Oct. 24	34	96	Rice, Vegetables, Bread, Mutton	29·935	29·820	76·4	85·0	75·2	78·0	0	
,, 25	30	96	Do.	·947	·857	74·2	85·4	73·6	78·0	0	
,, 26	33	98	Do.	30·018	·915	77·1	84·1	76·0	78·0	0	
Total 3											
Max	34	98									
Min......	30	96									
Average ..	32⅓	96⅔									
No. 20.—J., Age 34, Parsee, Cook.											
1860 Oct. 24	27	56	Bread, Rice, Mutton, Fish, Vegetables............	29·935	29·820	76·4	85·0	75·2	78·0	0	
	13	40	Do.								
	21	48	Do.								
Total 3											
Max......	27	56									
Min......	13	40									
Average ..	20⅓	48									
No. 21.—J., Age 30, Mahratta, Ward Boy.											
1860 Oct. 24	41	48	Rice, Bread, Fish, Vegetables	29·935	29·820	76·4	85·0	75·2	78·0	0	
	25	48	Do.								
	32	20	Do.								
Total 3											
Max......	41	48									
Min......	25	20									
Average ..	33	38⅔									

APPENDIX.

APPENDIX.

No. 1.

Report of a case of Hemiplegia and Hemi-Anæsthesia (*on opposite sides*)*: with especial reference to the views of Dr. Brown-Sequard.* (*Illustrated*).—By Assistant Surgeon H. V. CARTER, M.D., LOND.

Presented July 1860.

The pathology of the nervous system is confessedly obscure, for, until lately, the minute anatomy of the brain and spinal cord was but imperfectly known, indeed, until the researches of *Wagner, Van-der-Kolk, Stilling, Kolliker, and Clarke* were published. The physiology, too, of the same parts is even now to be completely and satisfactorily demonstrated; and it is but in accordance with one of the first principles of medical science, to conclude that *pathology* must depend for its development upon the materials and conclusions previously furnished by *anatomy* and *physiology.*

At the present time, there are accessible to English readers elaborate investigations of the structure and functions of a considerable portion of the cranial-spinal axis—the true spinal cord, including, as is meant, its cranial prolongations. Mr. Lockhart Clarke has laid open its anatomy, and Dr. Brown-Sequard has elicited most important additions to our physiological knowledge of these parts. But the adaptation of the two separate subjects, in all their details, has yet to be made: it may, however, be stated that anatomy reveals no peculiarity of structure, which can be shown to be directly opposed to the teaching of physiological experiments, or even of pathology. But, as might be expected, there are many deficiencies in the interpretation of the phenomena of disease by our anatomical knowledge. The subject is so recent that these "hiatuses" cannot but exist. One of them is found in the instance I am about to relate, for such as it require that a decussation of fibres should exist everywhere in the grey matter of the

cord: this has not been detected; hence Brown-Sequard has to explain the results of his experiments, and the pathological facts he has collected, by the supposition that *nerve-cells* assist to convey the sensitive impressions: I need hardly observe that the teaching of the day is, that such cells are rather the generators of nerve-force, and not its conductors.* Again, there are no visible *tracts* in the grey matter, adequate to the conveyance to the sensorium of sensitive impressions, as the views of Brown-Sequard require should exist. I might give other instances of apparent deficiencies, and almost discrepancies, such as the abundant decussation of fibres from the motor roots of the spinal nerves, which one might say, is hardly required in a physiological point of view.

There are, however, many striking points of concord between anatomical and physiological conclusions; such are those concerning the *posterior* columns of the cord, and the course of fibres from the posterior roots of the spinal nerves; and the very satisfactory confirmation of Carpenter's views of the course of nerve-fibres in the cerebrum, by the researches of Kolliker (see Manual of Human Historology, page 233, 1860); besides the instances already well-known and long established, such as the decussation of fibres and cross influence of volition, in the *medulla oblongata;* the general theory of reflex action, &c. In the instances of discord before referred to, I am bound to say that Brown-Sequard does offer an explanation which is plausible, and possibly correct. It appears rational enough to anticipate that, in no long time, the obscurity in many parts of this difficult subject will be satisfactorily cleared up. The case I am about to relate requires, for its elucidation, some such theory as Dr. Brown-Sequard has furnished. It is decidedly an uncommon one, but not more so than might be expected from the comparative infrequency of partial lesions of the spinal cord; several such cases are recorded by the Author referred to, of which his explanation is most successful. It may be interesting to consider, first, what his views are, as recorded in the Lancet, June to December 1858. These Lectures are on the physiology and pathology of the central nervous system; principally however of the spinal cord and its intercranial promulgations, the *medulla oblongata*, *pons varolii* and *crura cerebri*. He also treats of the influence of the *sympathetic* nerve, and gives a lecture on *epilepsy*. With regard to the spinal cord, the principal

* Note.—Recently a well-known investigator of the nervous system, Schrœder V. A. Kolk, thinks he can show an anatomical explanation of Brown-Sequard's position that the sensitive roots decussate in the cord: and that processes of cells in the posterior cornu ascend, and cross through the commissure.

novelties in his views include the following :—an explanation of the apparent sensibility of the anterior roots of the spinal nerves. This is shown to be caused by the *spasm* induced in the muscles under experiment, and may be called *recurrent.* It is considered probable that the fibres concurred in the muscular sense travel along the anterior roots. Next, the posterior columns do not transmit the least part of the sensitive impressions to the encephalon, nor do the lateral, or anterior columns, to any great extent; but it is chiefly through the grey matter, its nerve-cells, and nerve-fibres; those latter especially described by Clarke. This is essentially a novel view of the author. He then shows that a complete decussation of the parts conveying sensitive impression takes place in the *spinal cord,* near the attachment of the posterior roots of the spinal nerves, and not in the encephalon as Sir C. Bell thought. This too is the author's own theory, first started in 1849.

The track of the *will* is chiefly the lateral and anterior columns of the cord, except in the neck, where the anterior columns are not concerned. It is also partly the grey matter of the cord. There is no decussation in man of the nerve fibres conveying volitionary impulses in the spinal cord; this takes place, of course, in the *medulla oblongata.**

Almost every kind of objection that might be started against these views is noticed, and disposed of, by the author. His method is to narrate experiments, make his deductions, and confirm them by pathological facts. The latter are difficult, sometimes, to interpret, and he takes occasion to prove the following statements, with regard to softening of the cord, which it may be interesting to notice separately :—

1*st.* The cord may be softened and yet retain its structure and functions.

2*nd.* The grey matter may escape disorganization when all other parts suffer.

3*rd.* Some kinds of sensation may persist while others are lost, in cases of extensive destruction of the cord.

When it is said that some kinds of sensation may persist, it should be explained that physiologists now admit there are 4 or 5 modifications of the sense of touch, which includes touch properly so called, or *tactile* sensation, *pain*, *tickling*, *heat*, *cold*, all these different kinds of sensibility have probably separate nerve-fibres, and some may persist

* Those who wish for a complete summary of Brown-Sequard's propositions will find it in the Medico-Chirurgical Review for 1859, vol. xxiv.

while others are lost; several instances of this are given by the author. Hence for definitiveness' sake, it is necessary, in narrating pathological cases, to distinguish the *kind* of sensation that may be present or absent in anæsthetic parts.

The four other special senses, and the so-called muscular sense, are, of course, independent of the above.

Another curious modification of sensibility is minutely noted by the author, viz., its exaltation or *hyper*-æsthesia; this always follows limited injury to the posterior columns, and section of one half of the cord, existing in parts below the seat of injury; it is owing to a peculiar influence, and consists in great acuteness of the simple tactile sense. It was present in the case I am about to relate, and though not always observed, Dr. Brown-Sequard considers it may be found in similar cases.

Before passing to the subject in hand, one other circumstance investigated by the author may be referred to. It is this, the nerve roots, grey matter of cord, and its connections, and most parts of the encephalon acquire the power of being excitable, and of giving sensitive impressions which are referred to the periphery of the body, under the influence of inflammation, although normally there is no such power. The cases he adduces appear to show that when a feeling of *heat*, &c., is found in paralyzed parts it indicates inflammation of the grey matter of the cord, or other nervous centre. In my case, this feeling is very readily induced by any kind of contact, and hence it may be inferred that there is some irritability of the grey matter of the cord.

It will be quite enough to refer to the Lancet (1858, vol. ii. pp. 53, 54), for an account of some conclusive experiments, and (pp. 273, 274), for some pathological illustrations of cross influence of sensation in the cord; more than one instance is precisely similar to that I am about to narrate. Six or eight cases are fully quoted by Brown-Sequard, and he states that such are not so rare as many might think: they are not, however, numerous. Hence, besides such direct evidence, he gives other showing that the decussation of the sensitive nerve-fibres *does not* occur in either the pons or medulla; and by this negative proof, confirmatory evidence is obtained. Although many of the cases referred to by the author are not in reality *positive* proofs of his views, and the one I am about to relate is of the same kind, as no *post mortem* examination can be made; yet they are all so many collateral proofs, as it were; and for two reasons:—The first is, that the symptoms observed in these pathological facts are the same as those observed to exist in animals after a section of a lateral half, or some

such injury of the cord, so that it seems quite certain that similar injuries existed in this organ in these cases. The second reason is, that there is no theory adapted to explain all that we know of those cases except that proposed above. This is the author's own mode of reasoning, and it is very commonly made use of; in medicine generally we conclude many diseases to be of a certain nature, not from direct evidence, but because the symptoms resemble those of previous cases or results of experiments, and cannot be otherwise so well explained.

Case.

Jeferino de Souza, an Indo-European, aged 35, admitted into the J. J. Hospital January 27th, 1860, at 1 A. M. He had been found lying drunk in the road, having fallen from a window 8 to 10 feet high on to his feet on the road. *At* 7 A. M.—Is perfectly conscious and rational; but, except the head and neck, the whole body appears to be paralysed, breathing diaphragmatic, the chest not expanding; cannot move his right arm or leg and the left arm, but sensation remains. No head symptoms: the pupils seem a little irregular, but they act. No injury to the spinal column to be detected. There is a small scalp wound on the vertex of the skull exposing the bone, but this is not fractured or depressed: pulse slow and regular. Tongue protruded straight, speaks and answers questions. General aching pains. Ordered an enema and cold to the head; low diet.

At 5¼ P. M.—No headache; can move the right leg a little now, but the arm remains powerless; pulse rather quick, soft; ordered calomel gr. x. hss.

28*th.*—Same state, breathing diaphragmatic; the head is easily enough moved about: feeling of cold, or creeping, in the arms. Urine and stool passed involuntarily. Scalp-wound and pulse quiet. No heat of skin or difference of temperature in the two sides of the body. Catheter to be used twice daily. Half an ounce of sulphate of magnesia, *statim.*

29*th.*—Pulse quiet, skin cool, no increase of voluntary power over the limbs: no starting or rigidity: no headache.

30*th.*—Power returning in all the limbs except the right arm, the left arm he can bring to a right angle with the side, but no further, no rigidity in any part: some tenderness over the lower cervical vertebræ on pressure, but no displacement or irregularity. Repeat the enema: mutton broth and tea.

31*st.*—Aching pains in the arms. Apply a blister to the neck.

February 1*st.*—Pulse better, but no evident improvement yet.

2*nd.*—The right arm lays like a log: general aching pain.

3*rd.*—Slight improvement: iodine mixture ter. die.: to have an attendant.

4*th.*—There appears to be *hyperæsthesia* of the upper extremities and trunk; doubtful in the lower extremities: this is more evident on the right side, and is very marked. Dover's powder, hss.

February 7*th.*—Improving.

9*th.*—Rubefacient liniment: chicken.

20*th.*—Same feeling of itching in the arms.

March 1*st.*—About this time anæsthesia of the left side of the trunk and extremities became more marked, though it seems always to have existed to a slight extent from the first: no motor paralysis on that side. Arrack ℥ i.

30*th*.—Improving in strength; the right arm alone is quite powerless, no facial paralysis, complains of his teeth.

May 5th.—Steel mixture ordered: stimulating liniment.

June.—His present state is as follows:—The functions generally well performed. The head, neck, and upper part of thorax are unaffected in any way: but on the *left side* we meet with the following symptoms:—From the level of the mamma downward, there is anæsthesia of the trunk, limited precisely to the median line in front and behind; the same arm is also affected, and the corresponding lower limb which is most of all devoid of sensibility. The motor power is hardly impaired in any of these parts, though the limbs feel weak. Reflex action readily induced, particularly in the leg, by the mere application of the feet to the ground, or by tickling. On the other hand, the *right side* of the trunk, and the right upper and lower extremities, are affected with paralysis, the arm particularly, while sensation of all kinds remains intact. The limbs, particularly the arms, are somewhat rigid. The motor paralysis appears to exist to precisely the same extent as the anæsthesia of the opposite side.

It is to be regretted that more copious notes were not taken in the early period of this case, but its interest was not discovered till recently: as a case of concussion of the spinal cord, I had always paid particular attention to the patient.

Careful and repeated examination elicits the following additional particulars:—The anæsthesia is complete, there is loss of tactile sensation, tickling is not felt, pain cannot be produced, nor hot and cold bodies distinguished from each other: the two points of a compass are readily distinguished, when less than half an inch apart. On all parts of the chest, commencing below the level of the mamma, there is an *abrupt* loss of this power, and even all sensation ceases on the left side. As regards temperature, a small metallic plate dipped with cold water and applied to the chest, &c. &c. produced only a feeling of much warmth. When he bathes in cold water this is felt all over the side, but he cannot distinguish degrees of warmth, and almost all kinds of irritation produce this feeling of warmth or heat. As before said, this may indicate some inflammation of the grey matter of the cord.

The *galvanic current* excites sensation in the skin, and affects the muscles beneath to a diminished extent as compared with the opposite side; indeed it may be doubted whether any pain is felt in the skin. The leg shows these facts most. Electricity is now greatly assisting the cure of this patient. On the same side (the left) it does not appear that the *muscular sense* is greatly affected; he is aware of the condition of the muscles of the arm, can pick up a small object with the fingers, and can readily distinguish a light from a heavy body. A feeling of heat is roused in the fingers when they are applied to any object, and he cannot use a pen so as to form a letter. The palmar surface of the first and second joints of the fingers feel less benumbed than the tips. The limbs in general feel weak only: he cannot grasp firmly.* I have observed that the anæsthetic side is frequently *warmer to the touch* than the paralysed side. There is no wasting on either side.

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* In most of the cases collected by Dr. Brown-Sequard, the muscular sense remained unaffected: he however, gives some striking exceptions, p. 390, note. From certain considerations, he is of opinion that the decussation of the fibres conveying the impressions from the muscles takes place in the upper part of the cord only.

FIGURE showing extent and degree of Paralysis and Anæsthesia in this case.

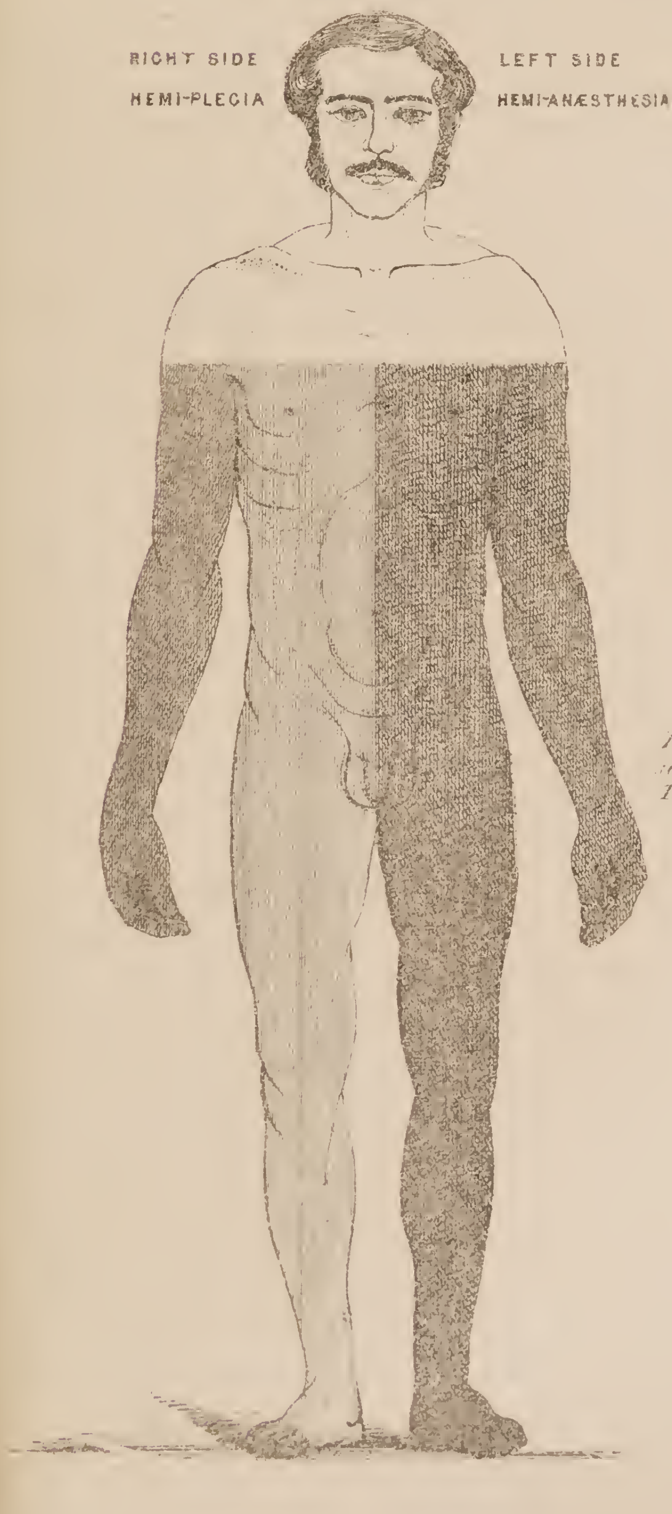
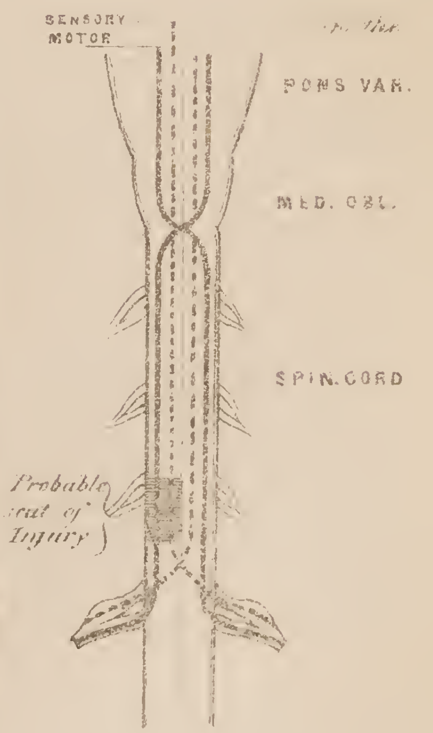


DIAGRAM to illustrate course of Nerve Fibres [illegible]



As regards the *extent* of anæsthesia, it is now least marked in the following localities; front of arm, also of fore arm; more marked in the palm of the hand;* the front of the abdomen, near the middle line, is now beginning to be sensitive. The sides, back, and the leg, are, most of all, devoid of feeling. This variation in degree is indicated in the diagram: it may readily be explained in the arm, on the supposition that the upper part of the brachial plexus of nerves is unaffected; such branches as the median, internal cutaneous, &c. having escaped.

With regard to the *hemiplegia* I have not noticed any peculiarity distinguishing it from the *cerebral* form; there have been rigidity and spasms of the paralysed parts, particularly the arm, which is by far the most affected: this is also the case with cerebral hemiplegia. The gait of the patient is unsteady and rather peculiar on the side affected with anæsthesia: the arm seems to hang and swing, being carried something like a foreign body; the leg trembles under him. On the paralysed side there are the usual symptoms of hemiplegia,—least evident, however, in the leg.

In looking over this brief account of the case, it may be observed, with regard to the early occurrence of *hyperæsthesia*, that the aching pains so frequently noticed may have indicated the approach of this previous to its having become so marked; it did not long persist apparently.

The conclusion one might draw as to the actual condition of things in this case is as follows:—Hæmorrhage into the right half of the spinal cord with subsequent low inflammation, commencing at the level of the lowest part of the cervical region, and extending to the lowest part of the dorsal, or even further. The grey matter on the same side is affected to a still greater extent, and the white matter of the opposite or left may be a little implicated. This I infer from the temporary motor paralysis there was at first in the left side. Posterior columns probably healthy.

The progress of the case has been latterly somewhat favorable: the paralysis is slowly disappearing, and even sensation is returning a little, *e.g.* at the anterior termination of the intercostal nerves. It has been noticed by physicians that, although sensibility may persist, even when motor power is wanting, in cases of softening of the cord, yet, when once lost, it is longer in being restored. This observation can be readily understood on the supposition, that the *grey* matter of the cord is affected when sensation is lost, as it cannot be re-produced probably. In conclusion it may be remarked, that cases of pathological interest are of great service to the physiologist; indeed, one can readily imagine

* He can just distinguish the points of the compass, but tickling is not felt below the elbow in front; and a sensation of cold may be here excited; the palm of the hand, however, less sensitive. The back and side of the limb are much deadened, corresponding very much, I suppose, to the parts supplied by the lower brachial nerves, the musculo-spiral, &c.

m 2

that the curiosity of the empirical physician was the prime mover to physiological enquiry, the desire to explain being intuitive and immediately consequent on the perception of an apparent difficulty or paradox.*

It is a great privilege, under these circumstances, to be aware of an accessible authority and guide; and I think, as far as injuries and diseases of the spinal cord are concerned, that, in those particulars he treats of, Brown-Sequard is worthy of our confidence. His views most satisfactorily explain the peculiarities of the case I have now related.

Postscript.—The further progress of this case has been as follows:—

July.—A feeling of heat in the anæsthetic parts, particularly in the lower limbs, where it is persistent. No spasms on the paralysed side. General slow improvement.

August.—The feeling of heat absent, spasms returned in paralysed side. To have $\frac{1}{10}$ gr. of strychnia ter. die.

September.—One night a sudden attack of dizziness and confusion; the head fell towards the left side, and the sight of that eye temporarily failed. General improvement continues.

October.—States that all along the posterior, or flexor side of the lower limb (left) and trunk, faculty of sensation is still in abeyance down to the sole of the foot; while on the anterior surface of both trunk and limb, down to the dorsum of the foot, sensation has returned. The motor paralysis is very much diminished: he walks quite steadily.

No. 2.

Operation for the Radical cure of Reducible Hernia.—By G. R. Ballingall, M.D.

Presented July 1860.

C——, a Hindoo, aged 26; a well-built, active-looking man; was admitted on 26th June 1860, with a reducible inguinal hernia. The tumor was of small size, and the contents (intestine) easily replaced; the external ring was small, admitting the finger with difficulty, and the latter could not be passed far into the inguinal canal, in consequence of the hernia being apparently a direct one. The first protrusion took

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* "It is a well-known tendency of the human mind never to rest satisfied with the mere observation of facts, without seeking to know their primitive causes; in this respect an absolute parity exists between the medical observer and the experimental physiologist; they both endeavour to combine facts in such a manner as will enable them to arrive at general conclusions."—Claude Bernard, *Med. Times and Gaz., September 8th,* 1860.

place about eight years ago, after sudden severe exertion in trying to jump over a wide ditch ; but he continued to do duty as a sepoy till a year ago, when he was discharged as unfit for active service.

As he was exceedingly anxious to have an operation tried, Wutzer's apparatus was applied on 28th June, a portion of the scrotal integument being invaginated and retained by the needle. No difficulty was found in the performance. He was then kept quiet in bed, the scrotum being supported by a pillow, and occasional opiates given. There was very little pain or constitutional disturbance occasioned.

On 8th July, ten days after the operation, there was only slight discharge from the needle puncture, and the instrument was withdrawn, the cavity being filled with lint, and a compress and bandage applied over the ring. The canal in which the plug had rested was excoriated and painful.

On 17th July the compress was removed, and the patient allowed to get up, wearing a truss. The wound was healthy.

On 20th July he had an attack of dysentery, the stools being scanty, containing mucus, and passed with much straining: there was, however, no reprotrusion. The purging was checked by ipecacuanha and opium ; and on 26th July he was well. Since then he has progressed favorably ; he walks about freely, wearing the truss, and forcible coughing produces no bulging at the external ring, which cannot now be distinctly felt. There is a hard cord-like structure extending from the lower puncture into the inguinal canal. The invaginated skin has descended nearly to its natural position, leaving only a slight depression about half an inch in depth.

Remarks.—This operation has now been very frequently performed in Europe ; in the majority of cases with permanent success ; in some instances with only partial relief, and in others with failure. It is simple in execution, and has only once, so far as I know, been followed by dangerous symptoms,—the patient (a cachectic man) having died from peritonitis. In a paper by Weber, published in the New York Journal of Medicine for January 1851, the following statement is made: "The radical cure is permanently established when the adhesions have taken place in the circumference of the entire inguinal canal. The hernial sac cannot leave the place into which it has been pushed by the invagination, as the needle has perforated it at two opposite points, and produced an inflammation between the serous surfaces sufficiently strong to secure, at least, at those two points firm adhesions. Wutzer considers it very important that his needle attack in this way the hernial sac, and thinks it very remarkable that Gerdy (who also

operates by invaginating the scrotum for the cure of a reducible hernia, and who perforates also by means of a needle the invaginated scrotum at the highest place to which he has pushed it) should state that his needle never touches the hernial sac. Wutzer says that it is contrary to the anatomy of the parts, and thinks that, if it were really so, Gerdy deprived himself of the most important means to secure the success of the operation."

With reference to this question, I am unable to say whether the sac is pierced or not, as I have not heard of any case in which a dissection of the parts after operation has been made; but it seems certain that the cure is effected by a portion of the sac being invaginated and retained by adhesion produced partly by the irritation of the needle and partly by the pressure of the plug. There is no other tissue involved which could offer resistance to the descent of the hernia, the skin invariably returns nearly to its original position, and the subcutaneous cellular tissue is too loose to prevent reprotrusion. On the other hand, the opposed serous surfaces, would readily contract firm adhesions, and the neck of the sac be thus effectually plugged and ultimately obliterated.

A more recent operation for the cure of reducible hernia has been performed by Mr. Wood, and it is said with even greater success than that of Wutzer. In this procedure an incision is made through the integument of the scrotum, and the finger introduced subcutaneously, pushes up a portion of the cellular tissue and sac; this is retained by a suture carried by a needle passed along the finger and made to pierce first the conjoined tendon, then Poupart's ligament, leaving a loop, and lastly through the inner pillar of the ring near the pubes. The two ends of the thread with the loop are all made to protrude through one aperture in the integument, by causing the latter to glide over the subjacent parts, and the threads are then tied over a round piece of wood. I cannot see that this operation possesses any advantage over the method of Wutzer. It is said, in addition to invaginating the sac, to draw the parts at the ring closer together and thus strengthen the abdominal wall, but though the thread when tightened would unquestionably temporarily narrow the ring, I doubt whether tendinous parts, such as those involved, would remain fixed in their new position, and I think they would most probably return to their old state soon after the withdrawal of the suture. In short, Wood's method seems to me to produce exactly the same effect as Wutzer's, namely, obliteration of the neck of the sac, while it has the disadvantage of being much more complicated, and probably more dangerous, as the thread suture

employed must cause more irritation than a metallic substance like the needle. There is too the want of that pressure produced by the plug, which seems to have considerable effect in producing adhesion.

Wutzer's operation has now stood the test of a good many years' experience, and in most of the cases the cure has been permanent ; it is of course needless to enlarge on the benefits obtained. In the present case, a young healthy man has apparently been rendered fit for active employment, besides being freed from the risk of strangulation occurring, and all this by an operation simple, nearly painless, and attended with very little danger.

No. 3.

Contribution to the Sanitation of Barracks.—By Assistant Surgeon T. M. Lownds, M.D.

Presented October 1860.

The present method adopted of removing *excreta* from European barracks in this country is not a good one, for it is always accompanied by very considerable nuisance, and the latrines are far from wholesome. All these places can generally be recognised by the odour, which they disperse to a very considerable distance to leeward of their position. The baskets used for receiving the solid portions of the *excreta* perform their purpose in a manner very inadequate to what is required for sanitary purposes. The fluid portions are soaked up by the chunam floors, and are gradually decomposed by the very elevated temperature which prevails, and are exhaled in the gaseous form to excite disease and debilitate the constitutional powers of all living within their influence.

It has been distinctly proved by the researches of Budd, Alison, Laycock, and others, beyond the possibility of doubt, that the exhalations from *cholera-excreta* at a certain stage of decomposition have the power of propagating the disease.* And it need not now be argued, that it is absolutely necessary to remove every known cause of this intractable pestilence. That such a cause, as the one above adverted to, can be removed, is as well known as possible. Nor is cholera the only disease produced by the exhalations from this decomposing animal

* *Note.*—The question here naturally suggests itself, may not cholera be rendered endemic in certain localities by these decomposing excreta ? The Bheels in some districts have worked this to a practical solution by experience, and whenever cholera becomes established in one of their temporary villages they abandon it at once.

refuse, dysentery and (so-called) diarrhœa are, with other ailments, among its results.

Besides the latrines, the urinaries are constructed on a most faulty plan. Apparently the urine is allowed to soak away into a cesspool without there being any water-valve to prevent the ammoniacal or other odours from escaping. The chunam slab is of course always saturated, and is always giving off its ammoniacal odour, which the small bag of charcoal, occasionally suspended from the roof, does wondrous little in removing. Again, I lately examined one of the cesspools which received the fouled water from the washing-room of a European Barrack. It was merely closed by a wooden top, fitting loosely. This did not of course prevent any gas from escaping, and on lifting up this lid, not two yards from the veranda, a dark seething fluid was seen, not more than a few feet below the level of the barrack-room and constantly throwing off a gas the smell of which was most disgusting and sickening. Personally I should infinitely prefer to sleep in a cot as far removed from such a nuisance as this as possible. I have little doubt that this cesspool for dirty water from the lavatory has been in use many years, and none will question, that a large space on every side has been contaminated by its influence. If cesspools of this kind are not far from wells, it is certain that the water in these last, will be greatly injured in quality by the fouled water having permeated the soil from which their supply is drawn. In the case to which I refer, the soil was of that light sandy nature which would permit the greatest dissemination all around of the nuisance, and wells were not very distant. For these nuisances, there is only one remedy, viz. removal of the noxious matter to a distance, and that removal must be conducted in such a manner, that no effluvium and as little decomposition as possible shall take place prior to removal. Disinfectants are but palliatives, and, as usually employed, are not nearly so useful as they might be made.

The best plan of removal is by glazed earthenware drainage pipes, when all *excreta* diffused through or dissolved in water are at once removed to a distance. To carry out this plan in its integrity would require a large supply of these pipes to be manufactured in India, and I am not aware that any such manufactory at present exists; but Jeffreys in the Appendix to "the British Army in India; the State of India, &c.," published in 1858, has the following remark at page 317: "The manufacture of firebricks, furnaces, and especially of vitreous pottery, left every other difficulty in the shade. The mineral resources of the country within a radius of 200 miles had to be explored. Men

were kept in all directions searching in the banks and beds of rivers, and by well-diggers, for earth and stones. Of the specimens brought in, hundreds had to be tested, and some were closely analysed. Eventually Bundlecund yielded three of the most important materials, and Rohilcund two others. It was not until after two years of unremitted efforts, persevered in, at one time almost as much by night as by day, and with an expenditure for this branch alone of more than three thousand pounds, that a manufacture was perfected of vitreous stoneware equal in quality to any in England, and on a large scale, from twenty-four to thirty thousand articles a month being produced." From this it is evident that such earthenware as would make excellent draining tiles has been produced in India, but the materials were brought from different parts. I have not seen in any paper on geology mention made of such a clay as would be applicable for this purpose with little preparation; but it is not I think at all improbable that some such clays may exist in the valley of the Nerbudda in connection with the coal strata there. I hazard this remark, knowing how frequently most excellent clays for such purposes exist in relation with the coal measures of the North of England. The enquiry for such clays in this country, bears a most important relation to sanitary as well as other matters, and is well worthy of being prosecuted.

But for the present some simple plan is required, and one that will not necessitate minute surveys of every station in India for sanitary purposes. The accompanying rough sketch is of a cesspool which would, I think almost as effectually as drainage pipes, purify barrack latrines and remove at least one source of disease.

I consider that it is absolutely necessary on sanitary grounds that ranges of European Barracks should be furnished with water-closets and urinaries of glazed stoneware, many forms of which embracing every desideratum, are to be found in the minutes of information presented to Parliament by the Board of Health. Some of these are completely cleansed and the water-valve closed with an expenditure of less than half a gallon of water. One cesspool would be sufficient for each range of water-closets adapted for two companies of Europeans.

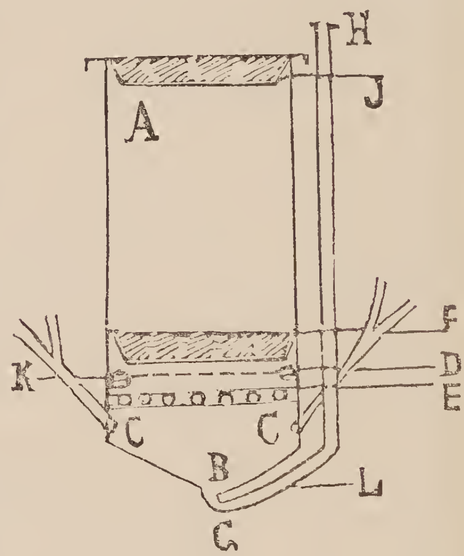
The mode of operation of this proposed cesspool is as follows:—The various pipes marked C. are connected with the urinaries and seats of the latrines, and as the lower part of the cesspool is filled; the zinc floats raise up the disinfecting apparatus FD, and the layer of charcoal F absorbs noxious gases immediately as they arise from the contents of the cesspool. It would be very easy to adapt a small apparatus for showing the waterline in the cesspool. When the cesspool is nearly

full, its contents are emptied by fixing the suction pipe of a force pump to the flange at H, and pumping the contents into similarly protected iron carts. During this operation, which would be required probably weekly, no effluvium would be exhaled, and the whole refuse could be at once removed to a distance of 3 or 4 miles and applied to fertilizing the surrounding country.

This plan as soon as the requisite apparatus is ready would, I believe, be far less expensive than the present plan which, as I have seen it carried out in various places, is expensive and very far from effectual. The cesspools, if properly constructed and coated inside with tar to be renewed twice yearly, would last many years; and I should think that after a few months' experience, the cultivators of surrounding districts would gladly afford bullock carriage from the barracks to their fields.

It may seem that this plan is unnecessarily expensive, but it must be remembered that it is an absolute necessity that every known cause of disease should be removed, more especially of such diseases as cholera and dysentery. I offer these remarks and this plan, feeling that the subject is of an importance to require every effort to terminate nuisances such as at present exist. Doubtless practical mechanical engineers would be able to simplify some parts of the plan, but of its practicability I have not the smallest doubt.*

A is a wrought iron circular cesspool of any sufficient size sunk into the ground so far that only 2 or 3 inches of its upper end are above ground. Its lower end B tapers gradually to the point where GH the exit pipe joins it. Its size should not be less than sufficient to contain 1200 or 1400 gallons.



CC are the entrance pipes from the water-closets. These may be arranged all round the lower part of the cesspool.

D is a perforated iron plate less in size than the cesspool, and having small wheels at four equal distances to facilitate its movements. D is supported on a series of zinc floats

* Since these remarks were written, I have seen in the Madras Quarterly Journal some suggestions that might well be adopted *at once* in cholera invasion; but a thorough removal of these matters should always be had in view, and we ought to bring more European experience to bear on these projects.

E, and supports on its upper surface a tray of charcoal F. This tray is formed of iron wire and is easily removed. K is supposed to be the waterline. GLH is the exit pipe, and is furnished with a flange at H to which the suction pipe of a force-pump can be attached. H must be strongly fixed. J is the cover and has attached to its under-side a tray of charcoal.

No. 4.

An account of Bassadore, and of the Fever prevalent there.—By Assistant Apothecary J. D. Rozario.

Presented by the Director General Medical Department.

Bassadore is situated on the extreme N. W. end of the Island of Kishn. In front its shores are washed by the sea in Clarence Strait; behind, its boundary is marked by a chain of irregular hills which run in a curved direction from a point at the Southward to the N. N. E.

The land thus marked, consists of series of plains of table-land, each rising gradually above the other as they proceed backward to the base of the boundary hills. But the first and the second of these table-lands terminate rather abruptly on the N. E. end, and overhang a low sandy plain, having on their sides numbers of little caverns, which probably have been formed by the action of the sea: such indeed seems to be the fact when the low plain is examined.

The low plain extends from side to side, to the distance of some two or three miles; and from before backward perhaps a mile, that is from the sea-shore to the base of the third table-land. The sea traverses over some extent of this plain; and probably, in some past ages, it may have traversed over a greater portion, if not the whole, especially at the great lunar fluxes (the spring tides), until the deposit of sand banked and limited it to its present extent. The table-land and the low plain constitute the portion of Bassadore land which is popularly divided into Modern and Ancient Bassadore.

Modern Bassadore is situated on the first table-land; it consists of low flat houses built with a species of mortar made with mud and sand, to which is added, whilst in a liquid state, a quantity of chopped straw to increase its cohesive properties; ventilation not being an object of general appreciation, there are but small peep-holes for that purpose and which are called windows. But some of the houses are surmounted by a kind of summer-house built with mats and bamboo, this is

m 3

dignified by the name of "Goopha" a Persian appellation meaning a storey; this, however, is a luxury that can only be afforded by the opulent of the inhabitants, and it may be considered as a sign that he who sports a "Goopha" is in a fair way of life. The houses are situated on the N. E. side, and are disposed of in groups, some of which unite and form a zig-zag; an example of this is to be seen on the East side, which is notoriously conspicuous, from being the resort of lewd women. One of the foremost of these groups has four or five shops and a great cook-house; this constitutes the Bazar of Bassadore. The remainder of the table-land is not occupied except at the S. W. end: on a point there is a bungalow with a flag-staff in front, and at the bunder-head a naval hospital, this being surrounded by heaps of coal, so that the first sight of it would suggest an idea of its being a coal depôt; between the hospital and the bungalow there are some dilapidated houses, and a barrack-room for marines.

Amongst the groups of houses, there are a number of wells containing brackish and bitter water; the latter abounds with salts of magnesia, its use giving rise to violent diarrhœa. Immediately behind the bazar, there are three or four tanks housed over; — a kind of reservoir into which rain-water is drained from the surface of the land. This is considered the softest and most wholesome water in modern Bassadore, but it appears to me to be a prolific source of guinea-worm.

Ancient Bassadore is situated on the low plain referred to, at the base of the third table-land, and is bounded in front by a beautiful grove of date-trees, amongst which are beds of vegetation in a most luxuriant state, and a number of wells, containing water of the purest quality. On the whole, it is a beautiful spot,—a spot contrasting strongly with its neighbouring parched-up table-land; enriched by nature, requiring but little aid of art to render it magnificent. Of this, however, the inhabitants are destitute; the village is filthy and miserable, built of low, flat houses, crowded together, having but little space in the shape of streets.

Waste.—This is not, in the strict sense of the word, a waste, but as it is so little brought into use, it may without impropriety be considered as such, taking care to except those parts that are in use. The third table-land also terminates in like manner as the first and second, but on the opposite side. Here are some spots apart from each other, with date groves and fresh-water wells, amongst which fruit and vegetables are cultivated. At one of these spots, there is a beautiful banian-tree (*Ficus Indica*). These being excepted, the remainder is decidedly a waste, which, however, is not owing to the intrinsic sterility of the soil,

but that it is so very rocky, that it could not be cultivated without enormous expense and labour, so that date-trees only are to be seen on the table-land. The formation of the table-land appears to be what the geologist would call *unstratified*.

Climate.—26° 30′ is the N. Latitude, 55° 17′ is the East Longitude of Bassadore. Climate when spoken of, is said to possess two grand divisions,—the hot and the cold weather; but still the four seasons are distinctly apparent, though they approach each other in character as to be separable into two great divisions, yet a closer attention will show changes peculiar to each. The Persians have sub-divided these again into twelve, and each are called after the signs of the zodiac, under a belief that they are in some way influenced by their respective planets.

Winter.—November, December, and January; when the temperature is at the lowest standard of the year,—the average minimum being 60° and the maximum 80°; the sky generally clear, with heavy fall of dew at night, but suddenly it becomes overcast with clouds of all description, chiefly nimbi and electric, which drift in a direction from S.S.E. to N.N.W., and from this point disperse and disappear; but frequently a squall comes from that point, and rain is precipitated in pretty good showers, attended with peals of thunder, sometimes with flashes of lightning: this lasts for two or three hours, and then the sky is all serene again. When the winter is regular, this happens frequently; if otherwise, it seldom if ever occurs; then the humidity of the atmosphere is great, the fall of temperature less, and the season unhealthy.

Spring.—February, March, and April; during which the temperature rises a little,—the average minimum being 63°, and maximum 83°. The sky generally clear; occasionally cirri-cumuli are to be seen during the day, which fade at night, and give place to a heavy fall of dew: sometimes a squall may come with a good shower of rain; this is but rare, unless the winter has been irregular.

Summer.—May, June, and July; during which the temperature is at the highest standard of the year,—the average minimum being 81°, the maximum 112°. Clouds but seldom appear; the atmosphere becomes thicker every day by a haze produced by half condensed particles of moisture. During the early part, the dew continues to form, when the nights are pretty cool; but soon after, the formation of dew is suspended, and then the nights as well as days are very oppressive. Sometimes the oppressive effect is moderated by land and sea breezes.

Autumn.—August, September, and October; during which the temperature lowers a little,—the average minimum being 74°, and maximum 109°. The early part approaches in character to the summer,

the latter to the winter. About the middle of August there is generally a break in the weather, from which the temperature commences to fall, and about the beginning of October the dew begins to form again; but previous to this, the weather is very oppressive, atmosphere hazy with humidity and particles of sand,—the result of frequent sand-storms that commence about that time, and last till the end of September.

Prevailing winds during the first two seasons are the N. Easterly and N. Westerly; during the other two, the land and sea breezes; but at the new and full moon there is generally great atmospheric disturbance, giving rise to storms, known by the names of Shamal and Shingy; at the N. W. and S. E. they last three to five days.

The inhabitants of modern Bassadore are few, such as those who have any dealings with the shipping; in truth, their dwelling is merely a matter of convenience. They are a mixed race of Arabs and Persians: the language current amongst them is a corrupted Persian: their living is poor. Amongst the wealthy, rice, ghee, meat, and wheat are used as common articles of food; the pullow, coffee, and some fatty sweetmeat, are also used, but on rare occasions, as a luxury; the poorer class subsist on fish and dates, but tobacco is a luxury enjoyed by all (of both sexes) in no inconsiderable quantity. As regards the physical character, the men are muscular, of various sizes; the females coarse and masculine, but, strange to observe, the latter are in the habit of shaving their eyebrows, and wearing false ones, pencilled over with prepared lamp-black called "Kagul." From their moral social system, nothing could be adduced that is likely to reflect any credit on them, except that they say prayers five times a day; being depraved, virtue exists in words only; and it appears to be a fundamental belief amongst them, that it can be polished up as often as the possessor of it chooses to tarnish it. But the inhabitants of ancient Bassadore are a people differently formed: they seem happy, though ignorant; they subsist on such food as the soil produces; they know but little vice, and are free from the natural consequences of it; their portion is health, and tranquillity reigns amongst them.

Intermittent fever.—In general, it is said that the quotidian is of the spring, the tertian of the summer, and quartan of the autumn; but, at Bassadore, the type and the severity of the fever seems to bear a direct relation to the intensity of malaria. Again, the intensity of malaria bears a direct relation to the quantity of moisture present in a condensed state, and the height of temperature; as these vary, so do the intensity of malaria and the type of the fever; but should one or the other be

wanting, the intensity of malaria is abated, or its generation is altogether suspended. Accordingly in October, when the atmosphere begins to give up its long retained moisture, the temperature being still high, the fever makes its appearance, and continues to rage until the winter has fairly set in with a good fall of rain, when there is generally a rapid fall of temperature from 20° to 30°; immediately the severity of malaria abates, and the fever becomes milder, and gradually disappears until the next October: it may occasionally appear in the spring and early part of summer in a mild form.

But should the winter be irregular, and pass without an adequate supply of rain, then the fever continues to rage with as much severity as in October, until the next summer when the formation of dew is suspended. This circumstance is, of course, contrary to the general impression, but a little reflection on the cause soon makes evident the reason why it should be so. There are other circumstances however peculiar to it, and which occur with such regularity as to seem an established rule common to the fever of Bassadore, the cause of which is so obscure, that reflection gives but little clue; and, in the end, we are obliged to leave the subject as we found it. For example—

First.—The fever is subject to the lunar influence; that, in obedience to the same, it choses a certain time to make its appearance, though the cause or the agent subservient to its production (malaria) may always be present; consequently, from the first to the fifth day of new and full moon most of the cases occur in the worst form; and when it commences first in the year it is on one of these days.

Secondly.—The fever when it once attacks its victim in any form, if left unchecked soon runs a rapid course, and exhibits its worst features. Quotidian runs into remittent, remittent into typhoid; and if the periodic quotidian and tertian should not run into a worse form, still they commit great ravages on the system of their victim by repetition from day to day.

Thirdly.—The fever, if it should be checked by interposition of art, has a tendency to recur at the lunar changes on one of the said five days of the new and full moon.

Fourthly.—The fever, in obedience to the same lunar influence observes a certain time to seize its victim; that the paroxysm, let it be a primary attack or a recurrence, supervenes at the time of high water, when the flood-tide is complete, before the ebb-tide commences, when there is, as it were, a period of repose from 10 to 20 minutes; this period is called the period of slack water, which, in most cases, corresponds with the cold stage of the fever.

Predisposing Causes.—All those that tend to debilitate the constitution, and amongst them may be enumerated all the predisposing causes of disease, but it is not absolutely necessary that some perceptible change should be produced; sufficient is it that any causes acting in such a manner as to lower the vigour of the constitution from that of the natural standard; this lowering may be so trifling as to elude the notice of the acutest observer, and the individual himself may be unconscious of it; numbers of those who sturdily resisted the influence of malaria at last become victims of it through some unaccountable cause, but on closer examination it turns out to be the want of the usual stimulants, such as is often done, the stopping of grog, or some such cause. But one of the greatest and most common is the hot weather, when the oppressive effect of the heat and the various skin affections common to hot climates, although they annoy and torment, produce but little change in the individual personal appearance and health, yet they do effect a change, and a great change too, which is but too subtle to be detected, whilst the individual himself exultingly expresses himself well and hearty. But in October, when the temperature commences to fall, and holds out a fair prospect of pleasant weather, the fell destroyer of health stalks abroad and finds but few cases to resist his baneful influence.

Exciting Causes.—Very little need be said under this head. To individuals already predisposed, and under the influence of malaria, any one of the exciting causes may bring on the paroxysm; but the moon appears to be the greatest excitor; it is not certain whether the influence of the latter excites or predisposes, but certain it is that it possesses a great influence on the paroxysms.

Symptoms.—Each of the types has its peculiar symptoms which it would be needless to repeat; the types most common are the remittent, quotidian and tertian; the first and last are rare; as for the quotidian and other complex forms of nosology, it has not been my lot to meet with them at Bassadore.

The length of paroxysms varies according to the severity of the cold stage; that, is if the cold stage be severe, though its duration be short, the paroxysm is longest, lasting full 12 hours; but if the cold stage be slight, from mere chills to moderate feeling of cold, though its duration be long, the paroxysm is shortest, lasting perhaps from four to eight hours. The premonitory symptoms are, a variety of feelings of languor, &c.; when noticed, quinine checks the paroxysms, but if once the cold be felt, do what we may, the paroxysms will come on.

Pathology.—A morbid material present in the blood which possesses a peculiar property by which a certain periodic phenomena (fever) is

produced, and which, by its presence, impairs the quantity of blood, and all the organic functions that depend on the due supply of that replenishing fluid; the resulting consequences are asthœnia and anœmia; this is reasonable enough and sufficient for all practical purposes.

But the question regarding the occurrence of these peculiarities puzzled me much, and the circumstance itself was a matter of no little confusion; in vain did I look for quotidian in the morning, and the tertian at noon; this made me suppose it to be anticipation and postponement, but soon I found this to be an error, it was neither one nor the other, but that the two paroxysms varied with the time of high water; on this and on the lunar influence I reflected for a long time, and the reference to books such as I possessed gave me no clue to these apparent causes. At last a vulgar notion attracted my attention, which, as a theoretical rule, is most conspicuous in the principles of old women who excel in quackery, that the turn of tide to ebb is the time most dangerous to patients, also that if a person was bled at ebb he would not bleed so well as he would at flood. This led me to inquire into the cause of, and the phenomena of tides.

The Tides.—Without entering into closer inquiry, the fact of the perpetual disturbance of the liquid portions of the earth is apparent, the rise and fall of the sea twice in the 24 hours. Agents instrumental to this are the sun and the moon; each of these make a tide of their own, but the tide of the sun is less than that of the moon, and when both are in conjunction, they give rise to spring tides, as it is at the new and full moon, the rise is the highest and the fall the lowest; but should the tides of each be across, the result is the neap tides, rise and fall are less. The atmosphere is subject to a like disturbance. Now to sum up the whole, the planetary influences of the sun and moon cause a general disturbance of the fluid portion of the earth; from the nature of this influence, let it be what it will (Newton has compared it to gravitation), I conceived a notion that the same planetary influence may affect the fluid portion of the animal system. Admitting such to be the case, the following idea is suggested:—Supposing if malaria be present in the system of man at the flood-tide, the circulation in him may be at its full vigour, enabling the system to maintain an ascendency over the effect of malaria; this would be similar to the constitutional resisting power; but just before the ebb there is a period of rest as it were, when there is neither flood nor ebb,—the period of slack water. The fluid circulation in man may experience similar changes, if so, the system will no longer be enabled to maintain that ascendency, and immediately the

system feels the effect of malaria, which is a sedative one, and the result is the collapse, or the cold stage of fever. This collapse is in proportion to the quantity or the intensity of malaria present, as also the succeeding re-action, the hot and sweating stages, are in proportion to each other, inasmuch as the continuance of one or the other of these stages would not be consistent with life; provident and ever ready nature overcomes one by causing another to succeed till the system is brought to the natural standard.

Treatment.—In treating the fever a host of remedies stand at our disposal:—emetics, purgatives, various diaphoretics, salines, and anti-periodics; all very tempting no doubt; but the pathology of the disease, its tendency to asthœnia, and anœmia, and the circumstance of its recurrence at the lunar influence, forbid the use of all but the last-named, whilst reason suggests that but little good can result from the former, and experience teaches that they are both unnecessary and injurious, inasmuch as they tend to produce that very state of system which renders it more susceptible to the influence of malaria, by the draining they produce. If there were certainty of elimination, then in all likelihood they would be warrantable; but there is no such certainty. We find, notwithstanding the use of emetics, purgatives &c., according to the indicatory symptoms, the fever does recur, and the certainty of recurrence is greater in proportion to the use of these active remedies, whilst the fever every time exhibits worse features, such as to call for more active remedies, and the succeeding convalescence is more protracted; should the recurrence last for five or six months, as it frequently does, it places the life in jeopardy from sundry consequent disorders. This is no illusionary statement: numbers of cases have come under my observation, that were due more to the said energetic treatment than to the disease itself. The most rational and successful plan I found to be the timely administration of quinine to check the paroxysm, and in the interval a steady course of some preparation of iron, aided by stimulants (spirits); the effect of the latter is so well marked as to be evident in a very short time. As for functional derangements, as soon as the fever has left, the natural powers were sufficient to restore them: if diaphoretics were used, they used to be of the mildest form. Should, however, there be any complication, which there is very apt to be, it must be looked for and dealt with accordingly.

As a preventive measure, when the fever season commences it is as well to attend to the men's living; taking care that their usual stimulants are not withheld, nor any reductions made in their dietary allowances.

No. 5.

Selection of Cases from the Records of the Kurrachee Charitable Dispensary.—By Sub-Assistant Surgeon BAZONJEE RUSTOMJEE, G. G. M. C.

Presented by the Principal Inspector General.

No. 1.—*Nævus of the parts above the left upper lip, and interior of the mouth, causing deformity of the face.*

Yamut, a Puttan, aged 25, native of the Candahar, occupation labourer, admitted as an in-patient on the 7th December 1859; duration of disease 7 years. Immediately above the edge of the upper lip, on the left side, is a small dark-coloured swelling of the size of a walnut. The enlargement disappears under pressure, but regains its usual size as soon as the pressure is withdrawn. It has a doughy feel, and small blue veins are visible underneath the skin. The outer mucous surface of the upper lip, contiguous with the integuments, is also swollen; the swelling is larger in the middle, tapering at the left angle of the mouth, and stops short at about a quarter of an inch from the right angle of the mouth. This swelling increases a little in bulk when the one above described is pressed upon. It extends inwards into the mucous membrane of the left cheek, and has invaded almost the whole of the surface to the extent of about three inches. Herein the blue veins are distinctly discernible, and are dilated into congeries of blood vessels, varying in volume from one-fourth to one-third of an inch. This inner swelling has pressed inwards the teeth of the left superior maxilla, has produced irregularity in their arrangement, and has caused serious deformity of the jaw as well as of the side of the face, which appears elongated and droops downwards, whilst the opposite side looks shortened and elevated—an appearance easily kept in mind when once seen, but difficult to describe in words. The teeth are coated with a thick coat of tartar. Small blue veins are also observable on the soft palate. The top of the nose and eyelids are also covered with minute nævi. No organic disease of the jaw-bone.

18*th December*.—The swelling above the upper lip was strangulated with strong double silk thread, introduced into needles, which were severally passed through the base of the tumour. The ligatures were cut off at the eye of the needles, and the tumour strongly tied in four places with alternate ends of the two different pieces of thread. On the fifth day the strangulated portion sloughed off and left an ulcer, which healed in a fortnight.

The larger and more formidable swelling remained untouched. There was considerable risk of hemorrhage from the dilated and tortuous veins, and the still greater risk of sloughing of the soft parts in the interior of the mouth. Moreover, the extent of surface involved in the disease precluded the possibility of including it in a single ligature, and the proper nævus needles were not to be had in the stores. Considering all this, I consulted Dr. J. Bean (the Civil Surgeon), and his opinion was that nothing could be done without running into greater risk; so the man was left alone.

I have detailed this case in full, as nævus affecting the soft parts of the mouth is, I believe, a rare occurrence.

No. 2.—*A peculiar form of partial Paralysis.*

Kulian, aged 39, occupation, petty trader; country Hindoo Tahona; sickness of 7 years' duration; native of Terra in Kutch.

Date of admission 26th January 1860. A middle-aged man in good health. Has a peculiar tottering and trembling of the head and neck from side to side and backwards and forwards. This quivering motion continues when he talks, and it increases when a person stares at him. The shaking continues when the head is supported, but it subsides when he is asleep. The trembling increases on the blowing and noise of musical instruments. Intellect and sensations unaffected. No muscular rigidity about the neck; pupils natural. Nothing peculiar about the countenance, save a little vacant look. Says he is giddy at night-time; feels palpitation and difficulty of breathing now and then.

On inquiring into his history, the following information was elicited:—

Says he has been twelve years in Sind, the last eight having been passed in Kurrachee. Was engaged as a runner in the Postal Department for six months. Does not recollect having received a fall or injury of the head. Says he had been to the sea-shore once to offer up his prayers, and while so engaged, he saw the following spectral illusion:—He saw a man in the form of a god on an adjoining wall; and as he approached the figure, he observed two in place of one. This turned his head and he became giddy, and on going home was attacked with fever for a couple of days, and thereafter the present symptoms came on.

He was treated with tincture of iron in ten-minim doses thrice daily, and zinc and opium pills at bed-time. A blister was applied to the nape of the neck, and he took the medicines up to the 6th February, when he left the dispensary somewhat relieved. About a month

ago he brought his child to the dispensary. On my asking him as to his disease, he said he was a great deal better, but the malady occasionally appeared in its full force.

In this case we have many symptoms resembling *paralysis agitans*, depending probably on an obscure disease of the brain in upper part of the cord. What the exact nature of the lesion may be, I am unable to say.

No. 3.—*Complete Anæsthesia.*

Vaidina, age 34; occupation cowherd; illness of three years' standing; Mussulman, native of Tesbela, in Sind. Is in good health; sensation absent over the whole body; motion perfect; intellect unimpaired; sleep undisturbed. The sensation is so perfectly blunt, that he does not feel any sensation of heat, even when he is placed before a strong fire. On pinching him powerfully, he was observed not to be affected in the least. He has no history to give, save that, sometime previous to the loss of sensation, he perspired profusely, chiefly during the evenings, and was greatly weakened in consequence. He was treated with arsenic; but, owing to the chronic nature of his malady, I did not hold out to him any hopes of recovery, and he left the dispensary after an attendance of four days.

This is the first case of complete loss of sensation I have ever seen; and I think it worth while to bring it to notice.

No. 4.—*Hydatid tumour on the ribs of left side of the Chest—Removal—Recovery.*

Ruttonbaee; female, aged 24; caste Borah. Period of growth of tumour seven years; native of Kutch, Mandavee.

30th May 1860.—Situated in the left lateral region, and extending in an oblique direction; is a large oblong swelling, $3\frac{1}{2}$ inches long and $1\frac{1}{2}$ inch broad. The skin over it is healthy and freely moveable; no attachments at its base: no pain. Crucial incisions were made in the integuments, and the whole of the tumour removed without any very great bleeding, although it was deep seated among the muscles.

The tumour weighed 4 oz., and was of the cystic variety. The external covering was fibrous; and on incision, discharged a clear fluid. The internal surface of this external tunic was in contact with another whitish cyst, which discharged smaller cysts or *ichinococci* of varying sizes from a marble to that of a pigeon's egg, and smaller. Sutures and straps were applied, and the whole covered with sponge and lint compress. The wounds healed in a fortnight.

Cystic tumours are not of uncommon occurrence, but the hydatid cyst, on the external surface of the body, is a rare formation, and particularly so in India, where hydatids among the internal viscera are also rarely met with.

No. 5.—*Worms in the Nose; cured by turpentine and other injections.*

Toolseedass, age 45; shopkeeper; Hindoo, native of Bhagnori, near Shikarpore; admitted 8th June. Says he felt pain in the throat and nose some five days ago, and discharged blood from the nostrils for 3 days; but the latter is stopped since the 6th instant, and succeeded by the expulsion of a number of worms. About sixty of the parasites were expelled yesterday. He now complains of pain in the head, nose, and throat. The nose is swollen thick and prominent two days since, and discharges thick fœtid matter. Its surface is erysipelatous since yesterday, and is painful on pressure. The saliva dribbles away from the mouth in small quantities. Has some fever since commencement of the illness; tongue slightly coated; pulse of moderate volume, and quick; eyes somewhat injected. Is in good flesh; no signs of a scrofulous constitution. Has never had syphilis. Ordered one and half ounces of quinine mixture every three hours. Inject turpentine into the nostrils, and alum and catechu gargle for the mouth.

9*th.*—Passed about 26 worms since yesterday; discharges of saliva less; swelling and pain of the nose diminished; continues to complain of pain in the head; no fever; tongue coated; bowels not opened. Repeat all as yesterday; calomel and colocynth pills at bed-time.

10*th.*—No more worms from the nose, which is less swollen, and discharges fœtid matter. He feels something crawling in the nostrils; bowels moved; tongue clean. Has pain in the throat, and slight ulceration on the floor of the soft palate; injection of the eyes. Repeat syringing and gargle. ℞ Infus. chiret. ℥vi acid nitric dil. ʒss. m. f. mist. ℥i twice a day. Pulv. Doveri gr. x. h.s.s.

11*th.*—Passed some blood from the nostrils yesterday. Pain in the nose continues less. The mucous membrane lining the nostrils is also ulcerated. Continue as yesterday.

15*th.*—Removed a large slough, about 2 inches long, which was hanging down from the palate. Repeat the gargle; syringe the nostrils with zinc lotion.

17*th.*—The removal of the slough has left a small circular hole in the palate; voice nasal; water and other drinks come out of the nose. ℞ mist. quin. ℥iii. tinc. ferri. sesquichl. ʒi. m. ℥i ter die sum.; continue the astringent gargle and injection.

The hole in the palate gradually contracted, and the ulcerations in the nostrils slowly healed. He was discharged at the end of the two months.

Some of the worms were brought to me by the patient. They were about $\frac{1}{3}$ to $\frac{1}{2}$ inch long, and of a white colour, with dark coloured points near the head and tail. In some, the dark points at the head were, as it were, bifed at the bottom. They appeared to me to resemble the common earth-worms. Such worms are composed of 10 or 11 spiral terms or joints.

Two cases of maggots in the nose were brought to the notice of the Grant College Medical Society by Mr. Misquita. The disease is also noticed in the 5th Volume of the Indian Annals of Medicine by Sub-Assistant Surgeon Toruckchunda, under the name of Peenash. In a fatal case reported by the latter, worms were seen in the cribriform plate of the ethnoid bone, and ulceration of the latter as well as of the body of the sphenoid. Dr. Morehead and Bapoo Toruckchunda believe that the worms are generated by the deposition of some sort of flies in the nostrils causing decomposition of mucous. From the history of the case, I am led to believe that the production of the worms depends on a state of chronic ulceration of the nasal mucous membrane, caused by the inhalation of minute particles of dust or flour which excite inflammation, and lead to the formation of thick matter, which is decomposed, and the worms are generated as in ordinary discharges. The worms and the hydatids were preserved in spirits, and forwarded to Dr. Carter of the Grant Medical College Museum.

The following three cases of poisoning by *Datura* were brought to the Dispensary on the morning of the 8th February 1860, under the following circumstances :—The party took lodgings for the previous night in a musjid. Seeing they had money with them, a couple of persons living in the musjid gave them boiled rice, mixed with poison, as charity, with a view to rob them of their money.

No. 1.—Mahomed Khan, age 25 ; caste puttan ; labourer ; duration of illness 20 hours ; native of Candahar.

8th February.—His friend says he ate five morsels at $8\frac{1}{2}$ A.M. of boiled rice given him by a Scindee in an adjoining musjid, and he ceased eating more from disagreeable taste of the food. He is insensible ; struggles violently ; cannot be held without the assistance of two or three persons. Tries to take off his clothes as soon as they are put on. Pupils are dilated ; pulse of good volume and frequent. The insensibility came on soon after eating the food. His body is covered with dirt and mud. Took medicine with difficulty. Ordered an emetic of 25 grains of

sulphate of zinc: cold lotion to the head. The emetic to be repeated at 9½ A.M. *Vesp.*—Vomited twice after the second emetic; is quite sensible; talks coherently, but the pupils are still dilated; purged seven times.

9th.—Nothing abnormal, save the dilated pupils, and a little dimness of vision: no purging.

No. 2.—Zoomokhan, age 25; Puttan, labourer; native of Candahar; ill for 22 hours. Eat six morsels of the same food as the former, the food tasted quite bitter, and he was unable to eat more. Is perfectly insensible; pupils dilated. Is seen taking up the dust and applying it to his body. At another time he is observed drawing out something between his fingers. Falls down on the ground, when he is raised up: eyes injected. Has vomited raw pieces of mutton; symptoms came on soon after eating the food. Took his medicine with difficulty. Emetic of sulphate of zinc and cold lotion as in the preceding case. *Vesp.*—Vomited thrice, purged six times; is sensible. Slight vascularity about the eyes: pupils dilated. Says he was sensible when a person came to him to take away his money-bag, and he beat him severely.

9th.—No marked symptoms, excepted dilated pupils.

No. 3.—Lall Mahomed Khan, age 28; Puttan labourer; native of Candahar. Took the same food, but vomited it immediately afterwards, and is sensible. Has no symptoms of narcotism, except a little wildness about the countenance, and dilated pupils. Talks coherently.

All three discharged on the 9th February 1860. Notwithstanding the uncertainty that is attached to the exact time of their taking the food, it is evident that more than twelve hours must have elapsed before they were brought to the Dispensary, and yet the poison proved harmless. The same harmless tendency of Datura poison is remarked upon in a large number of cases reported by Dr. Giraud, in the Medical and Physical Society's Transactions, and in Mr. Hormusjee Bazunjee's report submitted to the Grant College Medical Society in 1856.

No. 6.

A case of Hydrophobia, with a novel method of treatment.—By Assistant Surgeon W. J. MOORE, M.D. L.R.C.P. EDIN., in Medical charge Aboo Sanitarium.

W. D., Private, H. M.'s 33rd Regt.; age 21; completed three years of service; time on the station one year and eight months.

December 4th, 1860. About eleven o'clock A.M. to day, I happened to visit the Hospital, and found several individuals engaged holding the patient, who was struggling under their hands on his Hospital "Charpai." I found him suffering under convulsive movements of the whole of the muscular system, which came on at intervals of a minute or so, and assumed the form of *emprosthotonos*, and *opisthotonos*. The pupils acted naturally ; conjuctivæ slightly injected ; face flushed ; pulse although not bounding, full and quick, but without jar or thrill ; heart's action violent ; surface bathed in perspiration ; hands and feet warm ; countenance during the spasm distorted ; intermissions between the latter perfect ; and some frothy saliva issuing from the mouth. On speaking to him he appeared sensible of what was said, but was unable to articulate at all distinctly ; his attempts merely resulting in a hoarse croaking noise. The mouth was easily opened ; but during the spasms, the commissures of the lips were drawn back, and the teeth exposed in a ghastly grin ; while inspiration and expiration were performed with effort, and a hoarse bronchial noise.

The history I obtained *at the moment* was, that the man had been employing himself in the morning at his business (that of a shoemaker), that he had left his work in order to hear something* read from a newspaper ; and that while listening, he suddenly fell down, without scream or shout ; and commenced struggling and "choking." No one was aware of his ever having had an attack of the kind before, and his character was reported good.

After a few minutes (perhaps five) devoted to the consideration of this case, I dissolved one grain and a half of tartar emetic in an ounce and a half of water, and proceeded towards him, for the purpose of administering the dose. At the sight of this fluid in the measure glass, his countenance evinced great alarm, he endeavoured to put it away with his hands, and when they were held, he shrugged up his shoulders, trying to upset it, and *kept* his mouth *obstinately* closed against the administering of the medicine. During this time almost incessant, although decidedly intermittent spasms continued, together with constant hawking, spitting, and ejection of frothy mucous from the mouth ; while he constantly put his hands to the throat, as though "clawing" to remove some obstruction there.

Considering, however, from the state of the circulation, that the depressing effects of the antimony would be more likely to subdue this spasmodic condition and moderate the action of the heart than most

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* Relative to the Prince of Wales.

other remedies, I persisted in administering it, and as it was impossible to do so through the mouth (on account of the closure, struggling, spitting, and endeavours to eject), I gave it with a spoon through the nose (a mode of procedure, I have frequently adopted with unirritating medicines, when attending insane patients, &c.) which *nolens volens* necessitated the swallowing of the fluid by the patient.

During all this period, the convulsive paroxysms continued; the eyes became prominent, the face turgid; and the hawking, spitting, and clawing at the throat were almost incessant—with occasional violent screams; but more frequently hoarse cries.

Of course with this array of symptoms, I lost no time in enquiring from the companions of the patient, if they knew of his having been bitten by any animal, cat or dog; and one man, his particular friend, (G. H. by name), immediately stated, he had often heard the patient speak of having been bitten, he thought by a mad dog, but when or where the accident occurred, he was unable to recollect. On examination of the body and limbs, scars were seen on the thigh, but no inflamed wound.

After this, notwithstanding the sudden manner of accession, little doubt remained in my mind as to the nature of the disease, and knowing that it is uncertain if any remedies have the least influence over the affection, I determined to put in practice a plan of treatment which, so far as I am aware, has never before been made available. I allude in the first place to cold affusion to the head, with exposure to the open air; and secondly to quick vesication over the trachea and larynx.

Accordingly, I had the cot and patient removed into the verandah, and commenced pouring cold water on his head, from as high as I could conveniently reach, when standing on the side of the "Charpai." At this time the hawking, spitting, and clawing at the throat, were very incessant, and the first can-ful of water induced frightful spasms, both generally and of the muscles of the throat and chest. At the second can-ful, they became less intense, the pulse began to sink both in force and frequency, and the countenance became pale; three or four more cans-ful reduced the circulation to an intermittent condition, and the spasmodic phenomena subsided to a mere trembling; while the patient lay in a semi-conscious state, with tremulous eyelids, and sighing respiration as though recovering from a fit of syncope.

At this time occurred one of the most characteristic marks of hydrophobia. A stick happening to fall into a bucket of water, close to the bed, produced a splashing noise, which was immediately followed by a renewal of the spasms, and difficulty of breathing. I renewed the

cold affusion for a short period, with the same result as before; and while the patient remained in a quiescent state, I administered an injection of warm water and castor oil, which, remaining a short time, was eventually returned, without bringing away much fæcal matter. I also gave two drops of croton oil by the mouth (placing it on the back part of the tongue with a feather), and applied the nitrate of silver very freely over the trachea and larynx externally. It was now nearly two o'clock, and the patient appeared inclined to sleep. He was directed to be allowed to remain quiet.

On returning to see him at 3 P.M., I found spasms had occurred in a minor degree, and it was reported that motion or sound of water near him induced an accession. The pulse at this time was feeble and about 85, countenance pale, and head free from heat; the spitting and secretion of mucous continued; and in answer to questions he would only exclaim, "Oh what will I do! what will I do!" I now administered chloroform and after the inhalation of four drachms and a half, the anæsthetic effect, as far as complete relaxation of the muscular system, was obtained. He then remained quiet for a considerable time, not recovering from the effect of the chloroform for nearly one hour. At 5½ P. M. he was lying on his side, spitting and hawking as before, but the secretion of mucous was less. On offering water a renewal of the spasm in the throat was induced, but there was very little convulsive action of the general system. The man was evidently better, and he had no fresh remedy ordered.

9 P. M.—By this time the spasms had again increased both of the throat and generally, and spitting and hawking continued. He was quite sensible, but articulation was very indistinct. He did not seem to mind so much about the noise of water; but he was very restless, and continually clawing at his throat. I again administered one drachm and a half of chloroform, which induced relaxation, and I also applied the nitrate of silver to the spine. He now remained quiescent for more than one hour, when I administered by the mouth without producing spasm, but with evident reluctance evinced by the patient, five grains of the extract of Cannabis Indicus in two ounces of water.

12 P. M.—At this period the convulsive paroxysms had ceased. The breathing however was bronchial, and voice hoarse; the nitrate of silver had raised a blister, and the hands were constantly fingering the throat. Repeat Ext. Can. Ind.

December 5th.—This morning the patient lies in a quiet state, but the voice is hoarse, indeed almost lost. All other symptoms have ceased, and when asked if he has pain, he points to his throat and head: no medicine.

Vespere.—Improved in all respects ; but cannot articulate.

December 6th.—No fresh symptoms have occurred, and he can articulate more distinctly, but is very hoarse. In reply to questions, he now somewhat unwillingly states that, some three years back, he was bitten by a dog on the hand ; that he did not think the dog was mad, but that he killed the animal being afraid he was mad. He also stated that he had felt unwell previous to his sudden attack, and had been "cold all over," with aching of his limbs, and secretion from the nose. He did not, however, remember that he had felt his throat sore, neither had he been troubled by dreaming more than usual.

December 7th.—No fresh symptoms. Suffice it to state that from this time he gradually improved, and was discharged on the 15th of the month, having taken quinine for a few days previously.

Remarks.—In my opinion, this case is so extraordinary and interesting, that any apology for submitting so full a detail must be superfluous ; and for the same reasons, I offer the following brief remarks : 1st, as regards the diagnosis ; and 2nd, the treatment employed.

When I first glanced at the patient, struggling as he then was on a charpoy, under the hands of several men, and having been informed on entering the hospital compound that * * * had been "taken in a fit," remembering also the age of the patient, epilepsy immediately suggested itself to my mind. The character of the spasms, however, the hoarse croaking articulation, the ghastly grin,—sufficed to dispel this idea almost as soon as formed, and tetanus took its place instead. The clonic nature of the convulsive movements, the hawking and spitting, the evident affection of the throat, the absence of lock-jaw, and lastly the occurrence of spasm at the sight of water, in their turn almost immediately informed me, in unmistakable guise, that I must diagnose again before I could safely assert what the disease really was. Such being the case, what remained excepting hydrophobia? In what other disease should I have the signs and symptoms now presented before me? The answer was, in none! Then the fact being so readily ascertained that the patient had been bitten was added, and in spite of the manner in which the disease came on, I felt as sure as I do of most things not absolutely to be demonstrated and proved, that I had a case of hydrophobia to treat.

Now what are the symptoms of a well-marked case of hydrophobia? The best authors on the subject give them much as follows, although the enumeration is not a quotation, but my own description of the disease.

There is in *most* cases a *slight* pain or *uneasiness* in or near the wounded part; *sometimes* it becomes red or swollen and suppurates. There

may also be numbness or stiffness of the affected limb. *There are vague feelings of uneasiness;* oppression; gloom; irritability; frightful dreams; or in many cases, when the individual is aware of the injury experienced and the probable consequences, intense fear and dismay. Oftentimes there is considerable febrile action and vomiting. After a few hours or days the patient complains of stiffness of the neck, and slight embarrassment of respiration, which *suddenly* passes into *suffocating spasm;* most probably on some occasion when the individual *attempts to drink.* At first these spasms are excited only by the endeavour to swallow fluids: afterwards the *sound* or *sight* of fluids; any motion near the surface; the movements of spontaneous deglutition; even a draught of air, or a look from a bystander, is sufficient to excite them. During the paroxysms *all* the muscles are convulsed; the face is blue and turgid, and the eye-balls protruding. Sometimes the patient rushes violently about the apartment, in a state of maniacal fury, staring wildly, and "*clawing*" at the mouth and throat, as though endeavouring to remove some obstruction there. In some cases the patient is *remarkably silent,* and *refuses* to answer all questions. In others there is loud and garrulous talking, although the mind remains clear and unclouded to the last. In other instances there is raving delirium.[1]

In all cases, there is a copious secretion of viscid mucous about the mouth and fauces, exciting frequent hawking and spitting. There is often febrile action with hot dry skin and parched tongue. The convulsive paroxysms come on with increased rapidity and violence, in one of which the patient dies exhausted or asphyxiated. In some instances a deceitful calm occurs before dissolution.[2] In others, an aversion to anything white is noticed;[3] or to a looking-glass,[4] or other shining substance.[5]

With the exception of premonitory symptoms relative to the wound, all the most important, just enumerated, were prominent in this case; and that in this disease (as well as in most others), every symptom is not always present, we have most abundant evidence. For instance, Druit[6] says "in some cases" the disease is "unattended with redness or swelling of the wound" and "premonitory symptoms have not appeared, or have been so slight, as to have passed unheeded." Cop-

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[1] Watson, Lectures on the Prin. and Pract. of Physic, vol. i, p. 597.

[2] Bardsley, Cycl. Pract. Med., Art. "Hydrophobia."

[3] Meade, Phil. Transactions, vol. 5.

[4] Pickell, Notes on Hydrophobia, Sanitary Review, No. iii.

[5] Hooper, Guy's Edition of Phys. Vade Mecum, p. 311.

[6] Druit, Surgeon's Vade Mecum, p. 341.

land[1] makes much the same remarks: Elliotson [2] also. Watson [3] does not assert that premonitory symptoms are always present. In the two first cases related by Morehead, [4] the wound does not appear to have become affected. In the third case it is described "granulating and healthy," and in the fourth it was not inflamed. In four of the five cases related by Dr. Peet,[5] there was no suppuration or inflammation about the wound. Pickell [6] states the disease has been mistaken for a common sore throat; or for a cold, or feverish attack; or for rheumatism, or hysterics; and this author moreover adds, "truth is, that though all, with very few exceptions, agree in the main symptoms of dread of liquids and dread of air (hydrophobia and ærophobia), the difference in minor points in different subjects is so great, that in this respect hydrophobia, as has been said of some other diseases, may be said to be a Protean malady." In a case related by Druit, [7] there was no affection of the wound; and cases are quoted by Dr. Hawkins [8] and Mr. Hodgson, [9] where the choking spasm was considered sufficient for the diagnosis.

It may be objected that, in the absence of a suppurating wound, the patient was not proved to have been ever bitten by a mad dog, or other rabid animal, but it must be recollected that the patient himself killed the dog, being "afraid he was mad," so that there must have been evidently fear in the man's mind at that time, and probably ever since, although indeed he does not admit the latter. It would appear, however, from Mr. Hutchinson's writings, [10] that contact with a rabid dog's saliva may engender the disease without any wound or abrasion; and it is also tolerably well authenticated, according to Mons. Putgènat, [11] who relates a case of the kind, that the bite of a simply enraged animal has been followed by the same result, and this especially if the venereal appetite existed at the time. [12] Sir Benjamin Brodie [13] also mentions a case where the man died, but the dog who bit

1 Copland, Med. Dict. Art. "Hydrophobia."

2 Elliotson's Pract. of Physic, Art. "Hydrophobia."

3 Watson, Lectures on Principles and Practice of Physic, vol. i, p. 596.

4 Morehead, Researches on Indian Diseases, vol. ii, p. 648.

5 Peet, Med. and Phys. Soc. Trans., Bombay, Nos. 9 and 10.

6 Pickell, Notes on Hydrophobia, San. Review, No. iii.

7 Druit, Surgeon's Vade Mecum, p. 161.

8 Hawkins, Lond. Med. Gazette, Nov. 1837.

9 Hodgson, Lancet, 1838-39, p. 582.

10 Hutchinson on Hydrophobia, December 1838.

11 Putègnat, Gazette Hebdomodaire, June 1869.

12 Youatt, on the Dog and Hydrophobia.

13 Brodie, Lancet, 1833-34.

him remained well; and another instance of hydrophobia from the bite of an irritated, but not rabid dog, is related by Mr. Knowles.[1] Also a case is mentioned by Watson[2] where the dog's tooth merely indented the skin at the back of the hand. That a slight scratch or wound inflicted by a rabid animal is sufficient cause, there is abundant evidence in the writings of Youatt,[3] Breschet,[4] Magendie, and others. Youatt[5] also asserts that the rabid animal's saliva cannot touch the mucous membrane without danger, and Gilman[6] gives an account of a person who was licked near the mouth by a dog and became subject to hydrophobia. Stranger still, it has also been supposed by Pinel to arise spontaneously, and a case of real hydrophobia, supposed to have occurred without any infection, is quoted from the transactions of the College of Physicians of Philadelphia, Provincial Medical and Surgical Journal for 1850, page 225. Other observers have also recognized hydrophobia as occurring to individuals, whom it could not be proved had ever been bitten by mad dogs, or indeed by any dog at all. Fear has been supposed to cause the disease, and cases simulating hydrophobia are, if I mistake not, related by Dr. McCarthy in the Lancet for September 20th, 1833. With these facts, and others of the same nature which might be quoted, before us, I think it may be stated as fully proved that inflammation or suppuration of the wound does not necessarily occur as one of the prior symptoms of hydrophobia.

The next thing remarkable in this case is the length of time which elapsed,—three years as nearly as the man could remember,—between the occurrence of the bite and the development of the disease. Now the latent period is very variously stated by different authorities. The majority of cases occur between five weeks and three months from the period of injury, but it has been known to come on in three or four days afterwards; and also not until three, four, or even twelve years had passed.[7] This, coupled with the facts before mentioned, that so very small an injury is sufficient to induce the disease, is very suggestive, and if the origin was *not* the bite the patient acknowledges having received, it is at least probable that he may unknowingly have contracted the predisposition at some later period.

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[1] Knowles, Lancet, September 1834.

[2] Watson, Lectures on Pract. of Physic, vol. i.

[3] Youatt, *op. citat.*

[4] Breschet, sur quelques recher. experimentales sur la rage, October 1840.

[5] Youatt, *op. citat.*

[6] Gilman on Hydrophobia.

[7] Pickell, Notes on Hydrophobia, San. Rev., No. iii.

Regarding the treatment.—Most authors doubt if the disease can be cured at all; and although cases of recovery have been recorded after extensive bleeding, violent salivation, and the use of lead in large doses, "still as the remedies that were supposed to be successful in these cases have been used again and again in others without benefit, the recoveries may be fairly considered as accidental and spontaneous." Avicenna, however, remarked "*cura propinqua est ante terrorem aquæ;*" and Braugmarten, a German Physician, says "before the dread of water sets in, the cure is not only practicable but not unfrequent." Youatt, however, states it cannot be cured at all. Elliotson, Watson, and Morehead give little hope; and Pickell states that, like the plague or small-pox, it will run its course "without the possibility of checking it." It is, therefore, uncertain if medicine has any influence over the disease. Pages might be filled with an account of the remedies resorted to in vain. Amongst other extraordinary prescriptions, the blood of the spoonbill duck (!) was lauded by Dr. Mayes of St. Petersburgh so lately as 1828. Salt and water to wash the wound with and internally was formerly urgently recommended, and cases said to be cured by this homely remedy, may be found in an old work published A.D. 1758, entitled "Strictures on the present Practice of Physic."

The established practice of the present day, however, attempts little more than alleviation of the sufferings of the patient, by the use of opium, chloroform, Indian hemp, and other sedatives or narcotics. Ice has been found of great utility, cases being related by Dr. Todd, [1] by Dr. Garrett of Hastings, [2] and if I recollect right by others, when this substance was taken by the patient without producing the dreaded spasm.

Under these circumstances, I considered I was justified in practising what is, as far as I am aware, a totally new treatment; and although *prima faciæ* it may appear that the application of water to a patient suffering from hydrophobia, savours too much of "*similia similibus curantur,*" yet nothing was farther from my mind than any adhesion to the so-called "principles" of homœopathy. On the contrary, as I hope to demonstrate, sound physiological principles induced me to carry out a long pre-conceived idea regarding the correct practice to be pursued in cases of this disease. We all know that cold affusion reduces the temperature, lowers the circulation, soothes the nervous system, and disposes to sleep; also that cold applied to the head is one of the most valuable remedies in congestion or inflammation of the brain. It also

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[1] Todd, Lancet, January 1842.

[2] Garrett, Lancet, June 1859.

produces a powerful effect on the nervous system, blunting sensibility, and subduing pain. In cases of violent nervous excitement, or in paroxysms of mania, what remedy is so effective as a sedative? what so powerful to allay the irritability of the nervous system? thus fulfilling the indications for the treatment of hydrophobia; which may be stated (in the absence of any external wound): 1st, to diminish excitability of the nervous system; 2ndly, to remove the irritation or inflammation about the throat.

It has been already shown that the cold affusion fulfilled the first indication in a very marked manner; and for the latter, what would be more likely to produce the desired result than quick vesication? and what means of effecting this in a "ready method," equal in value to the free application of the nitrate of silver?

But the *rationale* of my treatment does not end here. After the force of the circulation had been moderated, the excitement of the nervous system subdued, and hence probably congestion within the cranium relieved, I administered chloroform: which *then* induced its relaxing effects, without exciting a renewal of that congestion, and without the renewal of convulsive movements, and evident flow of blood to the nervous centres, so commonly seen to accompany its exhibition. Had I given chloroform previously to the cold affusion, I fancy I must have added to the excitation already present, both from the obstruction to respiration and the spasmodic convulsions which the anæsthetic so usually causes. To render my ideas more patent, I consider that the cold affusion subdued the irritability of the nervous system, and the excitability of the circulation; and by *so doing* paved the way for the employment of chloroform.

The action of the *quick* counter-irritant applied over the larynx and trachea is so evident, that no remarks of mine can add to the importance of this measure as applied to the treatment of hydrophobia.

I am aware of the old English saying "that one swallow does not make a summer," but theoretically the treatment appears correct, and practically it *has* proved successful, *both* of which remarks cannot be applied to other measures, after which successful cases have been recorded; for instance, profuse loss of blood, salivation, and large doses of lead, before referred to. Most certainly, had I another case of the kind to treat, I should consider myself fully justified in pursuing the same *methodus medendi* rather than the empirical practice of bleeding, mercury, and lead.

In concluding these brief remarks, I may be permitted to state, that it is to me a matter of surprise that more cases of hydrophobia do not

occur in our Indian Hospitals, than we now have occasion to treat. To how many cities and towns in this country, may not, at the present day, the line of Horace in reference to the streets of ancient Rome be now applied ?

"Hac rabiosa fugit canis; hac lutulenta ruit sus."

No. 7.

*Report on the Sanitarium of Poorundhur.**—By Assistant Surgeon F. H. Plumptre, in Medical Charge.

Presented February 1860.

In framing a report of this Sanitarium, I propose to divide the subject under the following heads :—

1st. Geographical position, &c.

2nd. Buildings constituting the Sanitarium.

3rd. Climate and General Meteorology.

4th. Effect upon the European constitution, and the class of diseases for which it is best adapted, and for which marked benefit may be expected.

1*st. Geographical position, &c.*—Under this head, I cannot do better than quote from the pamphlet lately written by Dr. Morehead, the late Superintending Surgeon of the Division, entitled, "A Report on the Sanitaria of the Poona Division of the Army," in which Poorundhur is described as follows :—"The hill on which the Fort of Poorundhur is placed is an off-shoot from the Easterly side of the Western Ghaut range. It is situated in 18° 22″ N. latitude, and 73° 54″ E. longitude, and is distant 19 miles from Poona. It is a saddle-backed mountain. The altitude of the highest part of the ridge is 4,570 feet, but that of the lower Fort, in which the Sanitarium is located, is 4,200 feet. The lower Fort occupies a narrow table about a mile in length, projecting from the northern slope of the mountain. A good foot-road has been carried round the hill on the level of the Sanitarium, as well as round Wuzeerghur, an adjoining hill connected at the same level by a narrow ridge to Poorundhur. This foot-road is about 7 miles in extent, and in consequence of its circular character, its position 230 feet below the highest ridge, and the general form and

* This was an official report framed for a particular purpose, and not intended for publication.—*Ed.*

direction of the mountain, there is space for exercise, shaded from the sun, until 9 or 10 in the morning."

2ndly. Buildings constituting the Sanitarium.—At the present time the Sanitarium only accommodates soldiers, and for this purpose there are two barracks, situated at the east end of the cantonment, intended to accommodate 100 men. Each barrack-room is surrounded with a closed verandah, having windows which afford light through other inner windows into each barrack-room. It is by these windows, by apertures in the fan-lights, and by round tiles placed in the lower part of the walls, with others placed above and also some a little beneath the roof, that the ventilation is performed. It is proposed, during the ensuing season, to introduce a more systematic mode of ventilation, as well as several other alterations. The great objection to these buildings is the deficiency of light which, in the monsoon season, renders the rooms gloomy and dark. In connection with the building are the cook-rooms, wash-houses, latrines, library, canteen, skittle and quoit ground. The site is perhaps the most eligible that could have been chosen for the purpose, standing in an open, freely exposed situation on the piece of ground which connects the Hill of Poorundhur with that of Wuzeerghur. There is a sharp slope on both sides, so that the drainage is both rapid and effective.

The Hospital is situated at the extreme west end of camp, distant about three quarters of a mile from the barracks. It consists of four large wards surrounded by a closed verandah of the breadth of 12 feet, which on the western side is of the uninterrupted length of 211 feet, and thereby affords the inmates of the hospital the means of taking exercise when the weather out of doors is unfavorable. The whole of the Hospital is paved with flag-stones.

The wards are each 40 feet by 24 and 22 feet high, and are lighted by windows opening into the verandah, and furnished with fire-places. According to the original plan of the building, each ward was intended to accommodate 14 patients, or 56 in all, but this is inconveniently crowding; I consider 12 men in each as many as there should be. In the hot season, the number should not exceed 10; and in this opinion Dr. Morehead, when inspecting, concurred; consequently I never show more than 40 as the Hospital accommodation. In the event of emergency, the beds might be placed in the verandah.

The Hospital, on the whole, may be considered as a very admirable building, but it has one very great drawback, and that is, that during the monsoon season the wards are exceedingly dark, so much so that often, even in mid-day, it is impossible to see a patient properly without

a light. This is owing to the windows between the wards and the verandah not being of sufficient size to admit the requisite light, which might be easily remedied by placing fan-lights above. This serious defect was pointed out by the Medical Officer in charge when the building was completed in October 1857, and also in both of my Annual Reports in 1858 and 1859, as well as some minor defects in the arrangement of the latrines, &c., but these representations, I regret to state, are not likely to be attended with any immediate result, Government having intimated, that, at the present time, they do not consider it to be a work of urgent necessity. The wards are ventilated by means of the windows communicating with the verandah. It is intended to introduce some other mode of ventilation, although the urgent necessity is not apparent. It is seldom that the wards feel close or confined; and whatever the system introduced may be, unless efficient means are adopted to prevent the ingress of the mist during the rains, the advantage which may be gained during the hot season, will be more than counter-balanced by the evil in the wet.

The advantages of the Sanitarium have hitherto been confined only to the soldiers, but its benefits are now about to be extended to their wives and families. Since the beginning of the year ten new patcherries have been built. They are large, commodious buildings, the best I have seen in India, each consisting of two rooms, one 15 feet square, and the other 15 feet by 9, and about 15 feet high, with a wide verandah in front, and necessary offices in the rear; the front room is provided with a fire-place. The cook-rooms, of which there is one to five patcherries, are placed a little to the rear. These patcherries, with two previously existing, will accommodate twelve families, and are situated about midway between the barracks and the hospital. A female hospital has also been built, but is not quite ready for the reception of patients. It is situated about sixty yards from the south end of the men's hospital, and consists of one large room, accommodating eight patients; and two smaller ones, not communicating with the larger ward, for infectious cases, &c. There are likewise two rooms for the use of the matron. The cleaning of these buildings, including barracks, is performed by the sweepers, who carry the contents of the latrines some distance beyond the cantonment, and no annoyance is ever experienced from this cause. The water from the urinals is carried off by underground drains to some little distance below on the side of the hill, where it is allowed to percolate into the earth. There is no particular arrangement for carrying off the surface rain-water, for, from the very situation of the place, the rain that falls rapidly drains off into the valley below.

The water supply is abundant, and may be divided into two descriptions, the washing and drinking water; the former is obtained from wells near the hospital and barracks, and is of good quality. The water in the upper fort being particulartly good and clean is what is used for drinking purposes. In addition, near both these buildings are two tanks of considerable size, of stone-work, which fill during the rains from the surface drainage of the rain-water. This water is only used for gardens and common purposes.

Climate and general Meteorology.—The year at Poorundhur is divided into three seasons, the hot, rainy or monsoon, and the cold. The hot season is the one most suitable to develope the benefits likely to arise from change to a hill climate, and by avoiding the heat of the plains.

This season may be considered as beginning about the first week in March and terminating in the middle of June. I will not in this place enter into details of the temperature of each month, but refer to the tabular meteorological form, the materials for framing which I furnished to Dr. Morehead, and which will be found in his Memorandum on the Sanitarium of Poorundhur at page 208 of the 4th No. of these Transactions. The great distinctive feature which marks the difference of the climate from the plains at this season, is the general absence of hot winds, and the almost total exemption this place enjoys of anything like hot nights. A cool fresh breeze from N. W. sets in nearly every evening a little before sunset, and continues throughout the night. About the middle of April the thunder showers begin generally from the N. and N.E., and these occur at frequent intervals, increasing in violence until about the middle of June, when the rainy season sets in.

About the middle of May, indications of the approaching monsoon is manifested by large masses of clouds being seen on the surrounding hills towards the S.W., which sometimes extend to this, occurring most frequently in the morning, but sometimes in the evening also. The weather at this season is particularly pleasant, the mornings cool and bracing, and, combined with the increasing beauty of the scenery around, and the vivid verdure of the country, has a very exhilarating effect. I have, however, observed that, at this season, some of the convalescents who have suffered much from intermittent fever, are prone to recurrences of these attacks.

The rainy season extends from the middle of June to the end of September. The general character of the weather is gloomy in the extreme; for days and weeks together the hill is enveloped in mist, accompanied by constant drizzling rain; evaporation is entirely suspended.

The Sanitarium is open at this period, although the number of men is very much reduced, and the cases are carefully selected. The men remaining at this time, are generally those who have been resident for some months, whose Regiments are located at a distance (the season preventing their rejoining), and cases which are to appear before the Invaliding Board.

The effect of the climate at this season upon the majority of the men is unfavourable, not that it increases their ailments, a few cases excepted, but that it retards the progress of their recovery. The gloomy state of the weather, the absence of all sunshine for weeks together, combined with the impossibility of the men taking exercise without getting wet through, tend to produce an injurious influence, and great depression of spirits. It is, therefore, unadvisable to send men to the Sanitarium at this season, more especially if they are hospital cases, the dark state of the wards being an additional objection. During this season, one or two breaks generally occur in the weather, and continue for a week or ten days, and then it is difficult to imagine a more delicious climate. October and November must be considered separately or partaking somewhat of the character both of the hot and cold seasons. The weather during the day is moderately warm, and during the evenings and mornings cool. Frequent showers occur in October. This month is generally considered unhealthy in the Dekhan, many weakly men are therefore annually sent here at this season to avoid the climate below; and they derive much benefit therefrom. The cold season extends from about the 10th of November to the beginning of March, and is not considered a favourable season for the majority of invalids. The strong dry cold wind which then prevails, produces rapid evaporation from the surface of the body, with a disposition to internal visceral congestion, and is therefore decidedly unsuited to delicate men, especially those who have suffered from hepatitis and spleen diseases, dysentery and rheumatism. To men whose health is already pretty fairly established, and who are free from organic disease, the cold season is often of benefit. There is one class of cases which certainly seems to improve at this season, namely, dyspepsia dependent on a functional cause. At the beginning of this season, a large number of men are generally sent off the hill, either for the purpose of joining their Regiments as fit for duty, or to appear before the Invaliding Board, or as cases unsuited to the climate of Poorundhur during the cold weather.

4. *Diseases most suited to the Climate.*—The patients who derive most benefit are those whose health has been reduced below its natural

standard by the heat and debilitating influence of the plains, or who, having been ill from acute or chronic diseases, suffer a slow and tedious convalescence, but who are free from any serious organic disease. This was well illustrated last year. A large number of men of H. M.'s 3rd Dragoons and 17th Lancers were sent here from Kirkee, where they had suffered severely from continued fever; these men rapidly recovered, and after a few weeks' residence here were discharged to their respective regiments quite well. It is difficult to classify the diseases of the men who are treated here when they are sent; the summaries of the cases from their medical officers refer, of course, to the symptoms and nature of their complaints whilst under their treatment; thus, a man has been suffering from dysentery or continued fever when with his regiment, and he is sent here without a single symptom of the disease existing, but suffering merely from impaired health and debility; and yet in the return his illness is placed under the head of the disease from which he has been suffering, and for which he was sent here. If the diseases were correctly returned, at least 70 per cent. would be placed under the heads of debility and dyspepsia. I will select a few of the principal diseases common to this country to demonstrate the influence of this climate upon each class.

Quotidian, Tertian, and Quartan Fevers.—Where the disease is not of long standing and the patient is free from visceral complication, more especially if he is young or a new arrival in the country, great benefit may be expected from a residence here, and the selection of the season is not of so much importance as it is in those cases where the patient has been the subject of frequent attacks for a lengthened period, which has induced hepatic or splenic enlargement with cachexia. These I consider should not be sent here, except during the hot season; and detaining them during the rains must depend much upon the influence of the weather during May and June upon each individual. The cases of the most marked form of intermittent fever, accompanied by visceral enlargement and cachexia, are those which arrive from Kurrachee, and which is generally known throughout Western India as Sind fever. A large number of these men are often soldiers of several years service, who have suffered long from the disease, and, perhaps, have been inmates of the Ghizree Sanitarium, and thence transferred here, having derived no benefit from seaside residence or treatment: many of these, especially from secondary syphilitic disease, are broken in constitution, so that little permanent good is gained by the change. If the case, however, is a well-selected one, great advantage is gained by a rather prolonged residence, and many have returned to duty who otherwise must have

been invalided. These cases ought to arrive in the beginning of March and April; most of them, at least, be kept during the rains until the cold weather begins, and may then be discharged to duty. I generally recommend that, for some time after leaving here, they should do duty in the Deccan before returning to Sind.

Chronic Dysentery.—If the disease is quite in a chronic form, benefit may be expected by a residence here during the hot season, but the patients should be returned to Poona at the commencement of the rains, should any symptoms of the disease then remain. Residence here during the cold season is positively injurious. In diarrhœa, where the disease simply depends on some derangement of the digestive organs, and where there is no lesion of structure of the intestinal canal, I have seen advantage gained by a residence here during the cold weather.

Hepatitis.—Generally unsuited to this climate except during the hot season; if the disease, however, appears to be dependent upon intermittent fever, the same observations respecting that disease are applicable in a great measure to this. Where the disease has assumed the form of abscess of the liver, an indirect benefit may, I believe, be gained during the hot season.

Dyspepsia.—Cases not dependent on organic disease are benefitted by a residence here at most seasons.

Chronic Rheumatism.—This is a form of disease on account of which many patients are sent here; but it is very questionable whether much benefit is derived: in many cases it increases materially their sufferings; the patients are obliged speedily to return to the plains. Some marked exceptions, however, to this I have seen in cases sent from Sind, where a residence here during the rains has apparently removed all traces of the disease.

Phthisis Pulmonalis.—Incipient cases, especially in the hot weather, seem to benefit, and even in more advanced cases, by avoiding the heat of the plains, advantage is derived. At other seasons it is not desirable to send cases here.

In conclusion, I would beg to suggest one way in which the advantages of the climate of Poorundhur might be greatly extended to the European troops at Poona and Kirkee without in any way interfering with the present Establishment. The plans I would beg to offer for consideration is the occupation of two spurs of this hill called Fitz Clarence and Tiger Trap Points; both these places offer plateaux of ground capable of accommodating five to six hundred men. They might occupy temporary barracks—a building of masonry for a hospital being

erected, which, at the close of the season, might be used as a store-room for the building materials of the barracks. In this manner, a large number of men belonging to regiments stationed at Poona and Kirkee might be sent here in the beginning of March, and remain throughout the hot weather with every prospect of deriving great benefit.

No. 8.

Case of Abscess of the Liver in a child 17 *months old.*—By Assistant Surgeon R. Chapple, Royal Artillery.

Presented October 1860.

I was called on the 10th of November 1859, to see a boy aged 15 months, reported to be affected with dysentery. The following history of the case was given by the child's mother. The child arrived in Bombay from the Cape early in June 1859, and proceeded to Poona: whilst there, in August, was attacked with diarrhœa: in September left Poona for Baroda, where he arrived in October. The diarrhœa continued; but as the child did not lose flesh, and as he did not seem in the least affected by its continuance, his mother attributed it to the irritation of dentition. However, towards the beginning of November dysenteric symptoms presented themselves the child became peevish, and he lost flesh rapidly. When I first saw him he was passing blood tinged with mucous, with distressing tenesmus; tongue loaded; pulse quick; febrile excitement towards evening; night sweats; thirst, and loss of appetite. On the 10th of November, his mother told me that, when dressing or moving him, he showed the greatest anxiety if his right side was touched. With some difficulty, on account of the movements of the child, I made an examination and found the liver much enlarged; the left lobe extended far into the left hypochondrium, descended about 2½ inches below the ensiform cartilage, and about 1½ inch below the margin of ribs of right side: the enlargement could be traced by the eye. About this time, he was subject to violent paroxysms of pain, evidenced by sudden screaming and convulsive working. An abscess began to form about 1½ inch below the ensiform cartilage. Wasting away, loss of rest, and all the other train of symptoms daily increased, and the child died exhausted on the 26th December 1859. He was treated with iodine painting and fomentations to the side, tonics, anodynes, &c.

The parents of the child would not allow the body to be opened, but I made a minute external examination. There was great emaciation, the enlarged liver could be distinctly traced by the eye, the left lobe descended nearly 3 inches below the ensiform cartilage; midway in the middle of the enlargement, and in the mesial line an abscess pointed. It was soft, fluctuating, with discoloured skin, perfectly ripe, and would I should say, have burst in the course of 24 hours had the child lived. The skin surrounding the abscess was immoveable, and firmly adherent to the enlarged left lobe of the liver.

Hepatitis: Abscess bursting into cavity of Abdomen: Peritonitis: Death.—By Assistant Surgeon R. Chapple, Royal Artillery.

Presented October 1860.

Serjeant J. C., Royal Artillery, in India twenty months, a free liver, tall, and of strong frame, but reduced in flesh from sickness; admitted into Hospital on the 2nd of July 1860, with the following symptoms:—Severe pain in right side, shooting to shoulder of same side, and occasionally to lower angle of right scapula; constant vomiting, the matter green and intensely bitter; tongue brown and furred in centre, florid at tip and edges; face pale and bathed in cold perspiration; pulse quick and weak; bowels open.

He had been in hospital four times previously, labouring under hepatic affection. On the 21st of June he was last discharged from hospital, and placed on the convalescent list.

The urgent symptoms having been relieved, I made an examination, and found dulness on percussion commencing at the upper margin of the fourth rib and extending a little below the false ribs; the intercostal spaces of right side were filled in, and extremely tender on pressure; the left lobe of the liver felt hard and enlarged, and extended well over into the left hypochondrium. It would be tedious, and serve no purpose to enter into daily details; it will be sufficient to state that the patient was treated with nitro-muriatic acid, baths, tonics, anodynes at bed-time, Hyd. C. Creta and Dover's powder to check diarrhœa when present, and mustard sinapisms to allay irritability of stomach. Jelly, beef-tea, and a little wine chiefly formed his diet.

On the 15th instant, pain came on referable to the left lobe of the liver which was enlarged and distinctly traceable by the eye: anodynes were administered internally, and anodyne fomentations applied externally.

After the lapse of half an hour, the pain suddenly ceased, and the patient became collapsed, pulseless, with cold extremities, face pale, and profuse cold sweats. Stimulants were freely administered with constant friction to extremities, and mustard sinapism to chest and abdomen. After twenty-four hours perseverance in the above treatment, the pulse was perceptible at the wrist, warmth returned to the extremities, and the patient expressed himself relieved. The swelling before noticeable to the eye on the left side had disappeared, the hardness and tenderness also had gone. Towards the evening of the 16th, the patient complained that the effort to make water caused intense pain over the pubic region; the abdomen became hard, swollen, and painful; the knees were gathered up, every symptom indicated an attack of peritonitis. Morphia, in full doses, was ordered to be given every two hours; light warm poultices were applied over the abdomen, without a hope beyond that of mitigation of pain. The patient lingered on for seventeen days under the use of jelly, beef tea, and morphia, and died on the 2nd of August.

Post-mortem appearances.—Head not examined. *Thorax*, lungs collapsed, healthy; heart small, pale, walls thin. No trace of disease on opening the cavity of abdomen; the omentum was found firmly adherent to the walls of abdomen: having dissected it off, the cavity was laid open, and the following appearances noted:—On the left side a channel was formed by the wall of abdomen externally and the intestine internally; the space between was filled with pus, which when removed measured over three quarts. The intestines were so matted and adherent to the right side, that a space of about six inches wide remained after the removal of the pus. The omentum was attached to the intestines, and the intestines (bearing marks of ulceration in some parts and gangrenous in other) were so adherent to each other and to the viscera in which they came in contact, that minute examination was rendered impossible. The liver, adherent to diaphragm. Stomach, right kidney, and part of the intestines, ascended to the upper margin of 4th rib, the left lobe lay over the whole extent of stomach and formed the base of a large abscess, the walls of which were no doubt carried away when the abscess burst. On endeavouring to remove the liver for further examination a large abscess burst close to the *lobulus quadratus*; about two quarts of pus was poured out: the substance of liver was friable, and broke down under the least pressure. The right kidney was natural in size but of a yellowish colour when cut; the tubular could not be distinguished from the cortical substance, being of an uniform colour. The left presented similar appearances, but was not more than half the ordinary size.

Remarks.—That the patient did not sink under the shock to the system, already debilitated by long sickness, from the bursting of such a large abscess is very surprising, but not more so than that he held out for seventeen days after peritonitis had set in. The sudden cessation of pain on the 15th, followed by collapse, disappearance of swelling previously noticed, and followed in 24 hours by peritonitis, leaves the fact of the bursting of the abscess at that time beyond doubt. The absence of high inflammatory action and the exhibition of full doses of opium assisted the patient in his long struggle with the disease. I should say that the atrophied state of left kidney noted, was due to the long pressure of the effused pus upon it.

No. 9.

Report on the Ships "Clifton Belle" and "Dudbrook," which arrived at Kurrachee with Soldiers' Families in March 1860.—By Surgeon Major D. Grierson, M.D., Staff Surgeon, Kurrachee.

From Official Documents.

Clifton Belle.—On March 5th 1860, I visited the ship *Clifton Belle* on her arrival in harbour, inspected the ship and the Surgeon's books, and saw the passengers mustered.

2. On September 28th 1859, were embarked of the passengers, 284; and the remainder on October 6th, 1859. The passengers were, women 236, men 7, children 202, infants 7; total 452 persons.

3. The ship sailed on October 8th, 1859. Vaccination was performed at the Depôt; and one woman and her child were left in the Depôt, because the child had hooping-cough. The ship had fine weather throughout the passage.

4. Of the numbers treated on board,—both women and children being 192,—for affections of the bowels were treated 115; for affections of the chest 31; for fevers 32, hydrocephalus 4, diphtheria 3, scarlatina 2, dropsy 1, hepatitis 1. And of these died, of affections of bowels 9; and of the same combined with chest affections 8; of diphtheria 1; fever 1; hydrocephalus 1; and general debility 1. Two women died and 19 children. The sickness prevailed throughout, but was greatest in December. The deaths, however, were most in February. They were as follows: in October 1, in November 5, in December 4, in January 3, in February 6, in March 2. When we take

from this list the two women who died, of the 19 children remaining, 13 were of one year's age or under, and 6 aged 2 years.

5. The provisions seem to have been good and sufficient;—medical comforts abundant, water good. It was found difficult to maintain regularity and order; and the filthy habits of the people, and the uselessness of the Soldier Constables are complained of. There was great expenditure of medicines: those for the passengers were expended, and some of the ship's medicines also.

6. Punishments were sometimes inflicted on board this ship to repress irregularities.

7. The superficial space for passengers was according to artificial arrangement, for what is called statute adults—a measure by which two children between the ages of one and twelve years are considered equal to one adult; the space by this rule was 8 feet by 2, but by the natural order of taking each individual, 6 feet by two. And the cubic space by statute order was 113 feet, and by natural order 85 feet.

8. The Surgeon's books were neatly kept according to instructions; but that detail which would make them useful for the purpose of investigation is wanting.

9. The mortality in relation to those treated was 11 per cent. nearly, or one in nine of those treated died. Taking all the children on board, the mortality in relation to them was 9 per cent., or 1 in 11 died. These rates are high; and the question naturally arises, what were the causes of the mortality?

The mortality did not arise from any epidemic of infectious disease; for if the fever called typhus, of which three cases occurred on board, may be considered to belong to either of these classes of disease, it does not appear to have possessed the property of diffusing itself. The mortality was not occasioned by bad management. The instructions and rules seem to have been industriously and intelligently carried out; and the exertions of the Surgeon Superintendent seem to have been unintermitting. The mortality was not due to the state of the weather. The ship had fine weather; and though a ship sailing from England to India passes through various changes of climate, yet these unfavourable circumstances are little felt, and will not, in these instances, account for the mortality.

The Surgeon attributes the mortality to the imprudence of the mothers, who gave their own food and pickles to their children, even to those under treatment, and thus, as he thinks, occasioned and aggravated the complaints they suffered from. I would observe that the parents did in this matter, which is often adverted to, what they have

been used to do. People in the class of life of soldiers' wives do not prepare food for themselves and food for their children. The latter share in what the parents themselves use. But it may be said that the food was different to what they were used to, and therefore more hazardous or hurtful to the young children. In opposition to this, I would remark that, were much effect really due to it, then more of that effect should have shown itself in the adults; whereas, as regards mortality, it was limited to the children. Besides, whatever effect may be allowed to this cause, regard being had to the affections of the bowels, it will scarcely be thought sufficient to have produced the fevers and chest affections which were also numerous.

My belief is that the cause, by way of eminence, if not special, of the mortality is to be found in the contaminated air the sufferers breathed. The ship was ventilated by windsails, but had not the patent ventilators in use as in other ships. But no system of ventilation is adequate where space is so small. The foul air, arising partly from the ship, principally from the people themselves, depressed the energies of all exposed to it; but adults have both greater capacity of resistance, when exposed to influences which depress the vital powers, and on board ship can have frequent recourse to the best possible remedy for foul air—that, namely, of the open and uncontaminated sea. In this condition of an air unfit for respiration, and in the fact that children are sooner hurt by it, together with the necessary consequence of the sick being made both more susceptible of injury and more unavoidably exposed to the injurious agency that acted on them, consist, it seems to me, the causes of the varied sickness and great mortality, and particularly the reason why the mortality, with two exceptions, is confined to those of the tenderest years, six being two years old, and the great majority, or thirteen, being aged only one year.

Dudbrook.—I went on board the ship *Dudbrook* on the 6th March, the morning she came into the inner harbour; inspected the ship and Surgeon's Journal so far as it was kept, and saw the passengers mustered.

2. The *Dudbrook* sailed from Southampton on October 6th 1859. There were embarked on board—men 10, women 140, children 140, and infants 6; total 296: and three births took place on board. The people were received on board September 29th, and October 2nd, 1859.

3. The *Dudbrook* met with bad weather, and the bake-house and cook-house were carried away, and spars cast loose, but without injury

to any one, on the 18th October 1859. The previous day it had rained heavily, with strong wind.

4. Great sickness appeared on board this ship. There died of the passengers—1 woman, 41 children, and 3 infants; in all 45. The following table exhibits the mortality of the ship in the several months:—

Months.	Disease.					Total.
	Fever.	Measles.	Dysentery.	Croup.	Phthisis.	
October	1	5	1	2	0	9
November	5	6	4	3	0	18
December..........	7	0	2	0	0	9
January	4	0	0	0	1	5
February	4	0	0	0	0	4
Total....	21	11	7	5	1	45

It is seen from the above that, in the first two months, 27 deaths occurred, and the remaining 18 deaths were divided amongst the other months, the deaths of each of these three months being less than those of the one which preceded it; measles, a preventible disease, occasioned 11 deaths; but others besides those who died under that head were affected by it. Both croup and dysentery are apt to follow measles, and the Surgeon reports eight of those who died of fever to have been previously the subjects of measles.

As to age, there died of children of one year's age, 18; of two years age, 18; of 3 years, 2; of 4 years, 3; upwards of 4 years, 3; and 1 adult. Thus 36 were under the age of 3 years, and 9 above it.

5. There were no complaints of provisions or of water, which seem to have been good and abundant. Order was maintained with some slight exceptions at times; but the Surgeon commends, on the whole, the behaviour of the women. The Surgeon is reported to have been attentive and kind, and his medicines and the ship's medicines in good part were expended. As regards his books—what is called the Surgeon's Journal was kept till January 16th, 1860, when it was discontinued from bad health; but what is called the Medical Journal, to which in an investigation into sickness and mortality one would wish to have access, was not kept. Lest undue prejudice arise from this remark, it is desirable to dispose of it at once. If it were inferred from this statement, that the Surgeon was negligent in the care and dis-

criminating treatment of the sick, the inference would be wrong. If it were inferred that the neglect shown was in any degree to be compared in criminality with the neglect of the sick, the inference would not be wrong. If it were inferred that the omission to keep the Journal bore hurtfully on the sick, or indirectly aggravated the mortality, it is what I would not venture to affirm. There was a failure to observe the instructions given to the Surgeon in a point that concerns others rather than the sick; and though the omission occasions embarrassment now, the extent of the evil may be left to others to decide on.

6. The superficial feet in this ship by statute allowance was 8 feet by 2, and per head 6 by 2, and the cubic space by statute measure 116 feet, and per head 83 feet.

7. The number of sick children treated is not known, and the ratio of mortality to treated cannot be ascertained; but in relation to the whole number of children on board the mortality is 30 per cent.

8. One cause of this heavy mortality must be held to be measles; and this, under the method followed, was not guarded against with sufficient care. To have prevented the importation of measles into the ship, the passengers should have been kept isolated in the Depôt for a fortnight before embarkation, and every case detected should have been expelled from the Depôt. This was not done in this instance. A child was observed with measles, sent to hospital, and after eight days taken on board ship; and besides this, another child on the 2nd of October was sent on shore with measles, which was so far well; but, under the circumstances, it occasions no surprise to find the observation made in the Journal under date October 10th, "Measles throughout the ship." Exclusive, however, of measles and its effects, much remains to be accounted for.

9. Particulars have been mentioned as belonging to one or other of the ships which possess but a lesser degree of interest in relation to the causes of the mortality on board. It had been very desirable, for instance, that there had been no irregularities on board but perfect order, no want of cleanness, no quarrelling, no bad language, that the constables had been more attentive, active, and useful; but it cannot be supposed that these evils were permitted to assume a shape or frequency which compromised the well-being of the people, or occasioned sickness or mortality to any appreciable degree. The punishments, in fact, which in one ship were already noted, were designed to repress these evils, when at times they made their appearance. In one ship they never were inflicted—in another, in a very slight degree, and in that in which they were too obtrusive, both the frequency and character

of them I consider objectionable. To stop rations, whether dinner or tea, where women and children are concerned, is most irritating, and to put women in irons can be adverted to only with abhorrence, especially when it is on record in one case that a woman was released after four hours' confinement, because, being pregnant, it was not thought desirable to exact the full term. While it is clearly to be wished that these things had been different, and while it is admitted that the existence of them bears but little on the question of mortality, there are other conditions in the case which must be considered in a more serious light. The class of passengers was altogether peculiar. Women perhaps never at sea before, many with children, and without the help and counsel of their husbands, were suddenly cast on their own resources on board ship. Regularity, order, and punctuality, are essential to comfort and well-being, and the struggle to maintain them, amongst mothers unaided and burdened with many cares and duties, and the bitterness of failure, with many a harsh reproach from rude men, and unfeeling companions, must have engendered much exhaustion of body, and many a moment of deeply-felt anguish. And these were the women on whom, in circumstances like these, devolved the attention demanded by the healthy children and the care of the sick. Constables and sub-matrons there were it is true; but of these I make little account. Few women make good nurses, and of these, chosen promiscuously perhaps, not one is good. To blame women thus helpless and burdened, because they did not wait on the Surgeon for a written order for some medical comfort to be prepared by the cook, because they did not wait till it was prepared, or return for it at the precise period when it was ready, —to blame them for their omission, and because they chose rather to give their children what food they got for themselves, must have been felt by many to be mockery, or at least an attempt to enforce on them what was unnatural in the long abandonment of a sick child, and from the time demanded, impossible. The sick children therefore, I consider, were not sufficiently attended to. But besides the fact that the women were without their husbands, another peculiarity attaches to the class of passengers. This is the large proportion of children to adults. Had the husbands been with their wives, there must have been both fewer women and fewer children, and greater help for the healthy and the sick.

But the high proportion of children to adult women assumes importance in another relation—I allude to the space allotted. The computation according to statute, by which two children reckon for one adult, were children bales of goods and were superficial space only

regarded, no one would find fault with. Children, however, are living beings, of delicate organization, and, when denied the due cubic space and the requisite measures of pure air, sicken and die. The high proportion of children to adults was a condition of these passenger-ships full of danger, and the danger was not adequately guarded against.

Diet being changed suddenly from a less stimulating to a more stimulating quality, has been thought hurtful, and was considered by one of the Surgeons as a principal cause of the sickness on board his ship. This has been before remarked upon, and I will only add now that, had diet been a principal cause, not only should we expect to find similar sickness in ships sailing to Australia, which is reported not to be the case, however much difference in rank of life might tend to diminish it, but the sickness which prevailed should have had at first its maximum and then its regular decline; but this also was not the case. That the change of diet was innoxious, it is not meant to affirm, but if it is proper to restrict the hazard of the change within due limits, it does not appear how it is to be obviated.

Another point is the admission of infectious diseases. This ought to have been prevented. Twenty-three children died of the direct effects of measles, and how many were indirectly cut off by it is not known; four also died of scarlatina. These would have been a considerable deduction from the long death-roll. But the misery of an extensive epidemic, independent of the deaths on board ship, should have been prevented. Isolation in the Depôt before embarkation for a sufficient length of time was the simple and obvious means of effecting this. For the omission of it, I know not who is responsible.

I come now to the cause of evil in comparison of which all other causes might be almost overlooked. This is crowding of the ships. Space seems to be allotted on board ship according to views, if not random, at least wanting in scientific precision. Superficial feet are looked to, but cubic feet and the air they contain, are what is important. An adult respires in 24 hours 300 cubic feet of air, and renders it unfit to support health and life. To make this air respirable it should be mixed with ten times its bulk, and to make this increased quantity nearly pure, it requires to be diluted with ten times its bulk again. These statements are not vague conjectures, but results demonstrable by the help of data science recognizes. Now, were a man, shut up in 300 cubic feet of air without access of fresh air for 24 hours he would breathe an air in which plants would die, and in which he could live but a little while. It is the renewal of the air which maintains life. These facts being understood, and the statement being made

that, on an average in these ships, the cubic space allotted to each individual was only 80 cubic feet, it must be evident that, for the requirements of those on board, the space allowed was very disproportionate. Deprived of the renewal of the air of the space in which they lived, in eight or ten hours some must have died. It may be thought, then, that the renewal of the air by the means adopted for that purpose,—in other words, the ventilation,—was designed and adequate to compensate for want of space. This position cannot be granted. There would have been needed, in order to maintain pure air in the ships, no less than 1,000 cubic feet of fresh air for each individual every hour. That this could have been procured is impossible. On the contrary, with light winds, ventilation would be next to nothing, and in bad weather, and for other reasons, very little. But it may be said troops are carried out with the same allowance, and they do not suffer. The fact is admitted, and it is interesting and useful to give here a very recent and striking instance of it. There were brought from England to Kurrachee and Bombay, between November 1857 and March 1858, troops in 24 ships to the amount of officers and men 8,975, women 196, and children 177, and among this army, the number of deaths from sickness was eight. * Troops are closely stowed when below, but never more than two-thirds of the number embarked go below at once, and by day all are on deck. All are healthy and strong who go on board, able to spring on deck when they feel uneasy from foul air, and find excitement and pleasure in scenes and things that are terrible to helpless women. To enforce the rule of being on deck in respect to women and children must often be grievous and alarming to them, and by night all must be below. Sickness also compels the sufferers to be below. These differences are most important, and are strongly illustrated by the fact, that, in the troop-ships spoken of, women and children, accompanied by husbands and fathers, came out safely; whereas, had they been put in a ship by themselves, suffering and deaths amongst the children would have been the consequence, just as they ensued in the same course adopted with respect to the ships under consideration. Whatever casts light on this subject has a high value and significance. That the youngest children were the sufferers is a fact of this kind. Of the children on board these three ships, 93 died; and of these 93 deaths, there were 43 of one year's age, 34 of 2 years' age, and 16 of 3 years of age and upwards. Under 3 years of age there died 77, over 3 years of age 16. The explanation of this fact I prefer to give in the words of

* Med. and Phys. Society's Transactions, No. V. New Series 1860, p. 49, Appendix.

another: "Man is everywhere exposed to agencies which act injuriously upon his body, disturb the actions of its economy, and ultimately extinguish life. All these noxious agencies may be termed causes of mortality. On the other hand, in the constitution of the body are inherent conservative powers which resist the influence of the causes of mortality. The actual mortality at all times will, of course, be according to the relative strength of these destructive agencies, and the relative weakness of these conservative powers. Such states become tests, often exceedingly delicate, of the pressure and power of the destructive agencies to which the body is exposed, and such are the states of infancy and sickness. During the prevalence of these states, in which the conservative powers of the body are weak, life is destroyed by causes, which do not prove mortal in other conditions of the system." Accordingly, 77 children died under 3 years of age, 16 over 3 years and 3 women only.

10. The vitiated air of the ships is the one cause, common alike in fine and foul weather, in heat or cold, to all the ships, and uniform in all in exhausting power, depressing life, and through the irritability thus induced determining according to individual peculiarities, at times fever, at times affections of the chest, at times diseases of the bowels, marked by peculiar fatality, and this, in my belief, is what has made this enterprise a memorable failure, and these ships pest-houses.

No. 10.

Note on a Species of Gentian-wort forwarded by Dr. Broughton from Mahableshwur.—By Assistant Surgeon G. C. M. Birdwood, M.D.

NATURAL ORDER—GENTIANACEÆ (*Lindley*).

Ophelia multiflora (*Dalzell*).

Sexual System.—Tetrandria Monogynia.

(Herb and Root—*Dr. Broughton.*)

History.—I received a dried specimen of this plant on the 13th of January 1861, from Dr. Broughton, Superintendent, Mahableshwur, who, in an accompanying letter, requested me to lay it before the Medical and Physical Society of Bombay, as it appeared to him an excellent substitute for *Gentian* and *chirayta*. At the above date I considered it an undescribed *Ophelia*. On the appearance (February 1st

1861) of the "Flora of Bombay" however, I found the plant had been long known to Mr. Dalzell, and that it was the *O. multiflora* of that botanist.

Botany.—A herb with square stalks, winged at the angles; leaves opposite, acute-ovate ("mucronulate"—*Dalz.*), clasping, three ribbed ("five"—*Dalz.*), decussate; inflorescence cymose, dense; calyx four-cleft deeply, divisions lanceolate; corolla white, pencilled with purple within, four cleft, deeply, the divisions acute-ovate, alternate with those of the calyx, longer, and twisted to the right in æstivation; the margins of the glands at the base feathered; stamens four, inserted in the throat of the corolla; filaments dilated at the base, and submonodelphus; ovary one-celled; stigmas two, sessile; capsule one-celled; placentæ spongy; seeds minute, numerous.

Every part of the plant is intensely bitter.

Habitat.—Mahableshwur.

Pharmaceutical description.—(*a*) The dried root, size of a quill, two inches long, tapers, gives off two or three rootlets covered with a whitey-brown epidermis, longitudinally wrinkled, internally white, brittle. (*b*) The dried herb; stalks branched at intervals; branchlets opposite and decussate; main stalk covered with a purplish-brown epidermis, subterete, but distinctly winged at four corners; minor stalks greenish, quite square, and obscurely winged; leaves adherent throughout. In *chirayta (Ophelia chirata)*, the stalks are terete; and in *kreat (Andrographis paniculata)*, the four-sided stems are wingless.

Commerce.—Sold as a bitter in the bazar at Mahr.

Actions and uses.—As *Gentian* and *chirayta*, and might be advantageously substituted for these; the first being obtained from Europe, and the second from Nepaul.

Preparations.—As the drugs mentioned in the preceding paragraph. Dr. Broughton forwarded the *extract* with the plant.

No. 11.

Report and Analysis of various kinds of Coal.—By Assistant Surgeon R. Haines, M.B., Acting Chemical Analyser to Government.

During the year 1860 several specimens of coal were submitted to the Government Chemical Analyser for anlaysis. They included coal from Australia, imported experimentally for steam use; from the well-

known beds in the Nerbudda valley; from the immediate neighbourhood of Nagpore, where deposits of some extent have been discovered; and from the Lynah valley near Kotree in Sind. The following is a summary of the reports furnished thereon.

The Australian coal is jet black and brilliant; very brittle, and breaks with a cubical fracture, like Newcastle coal. The Nurbudda coal is dull black, heavy, very hard, being pulverized with difficulty; it has a laminated structure and cleavage: interspersed in its substance are seen here and there small lumps of half formed coal, like charcoal. The Nagpore coal is very similar in appearance to the Nurbudda coal, and has the same texture, exeept that the laminæ are alternately dull and glossy. The most noteworthy results of the analyses are indicated in th following table, and analyses of Welsh, Scotch, and Newcastle coal are added for the sake of comparison:—

Description or Locality of Coal.	Specific gravity in lumps.	Per Cent.			
		Coke.	Volatile matter.	Ash.	Sulphur.
Australia	1·312	68·27	31·73	8·38	·59
Nurbudda Valley	1·440	66·63	33·37	18·09	·60
Nagpore	1·417	76·00	24·00	18·73	·34
Sind	1·174	49·14	50·86	3·94	4·06
Wales, Steam coal, from	1·275	62·5	37·5	1·25	·33
To	1·350	88·1	11·9	6·94	5·07
Average about	1·31	80	20	3	1·25
Scotland, from	1·200	49·30	50·70	1·13	·33
To	1·316	59·15	40·85	14·57	1·57
Average about	1·20	54	46	4	1·1
Newcastle, from	1·23	62·7	37·3	·20	·06
To	1·31	72·3	27·7	13·91	1·85
Average about	1·28	66	34	4	1·0

The Australian coal is bituminous, and cakes like Newcastle coal. The Nurbudda and Nagpore coals do not even sinter together in coking; they would appear therefore to be not well suited for that operation. The Sind coal does not cake, and leaves a light, charcoal-like coke.

The ash of the Australian coal is of a dirty white colour, and the table shows it to be rather abundant; that of the Nurbudda

and Nagpore coals is much the same in appearance, but in very large proportion, and its abundance, by clogging the fire-bars, must detract a good deal from the utility of the coal, independently of the loss of the carbonaceous matter whose place it occupies. The sulphur in all three specimens is in moderate proportion. The Sind coal is in reality a half-formed coal, properly "Brown Coal," a variety peculiar to the more recent formations, and retaining many of the characters of vegetable matter, one of the most striking of which is, that the liquor which it yields on destructive distillation is acid like that from wood, instead of being alkaline, as that from true coal is. It contains the large proportion of 11·83 per cent. of hygrometric moisture, which, as also the low specific gravity, is a common characteristic of this species of coal. The large quantity of sulphur contained in the Sind coal is very prejudicial to its use by wasting the boilers. The coal has also the disadvantage of being extremely brittle, so that it flies into small pieces on the application of heat. The consequence is that the fragments fall through the firebars into the ash-pit, and, slowly burning there, give off such copious fumes of sulphur, that the firemen can hardly stand to their work. A trial was recommended of the Welsh plan, of burning the coal upon a layer, four or five inches deep, of clinker or broken stone. The ash of this coal is very moderate in amount, of a deep red color from the abundance of iron.

One of the most important elements in the determination of the value of a fuel is, of course, a knowledge of the heat which it produces in burning. Accurately to ascertain this, requires the use of a peculiarly constructed apparatus, fitted to absorb the whole of the heat given out by the combustion of a known quantity; but in default of this, a very good approximation may be obtained by the method introduced by Berthier, of fusing it with litharge, the quantity of lead reduced by the fuel furnishing a measure of its heating power. The result of this method is given below, from a mean of two assays for each, together with a view of the calculated heating effect with regard to water. But, as it is impossible to utilize the total quantity of heat produced, a large allowance must be made in forming an estimate of the practical value of the fuel.

The loss varies according to the arrangement of the boiler and flues and the management of the fire, from one-half to one-fourth, but is seldom reduced to so low a proportion as the latter, the average evaporation effected being something less than two-thirds of that of

which the fuel is theoretically capable. A comparison is made with British coals, as in the former table:—

Description or Locality of Coal.	Lead reduced by one part of Coal.	Pounds of Water raised from 80° to 212° by 1 lb. of Coal.	Pounds of Water evaporated from 212° by 1 lb. of Coal.	
		(Theoretical.)	(Theoretical.)	(Practical Estimate.)
Australia	21·64	66·69	9·09	5·64
Nurbudda Valley	17·46	53·81	7·33	4·54
Nagpore	20·83	64·20	8·75	5·42
Sind	19·21	59·27	8·07	5·07
Wales, steam coal from	28·92	89·07	12·18	7·55
To	34·06	105·02	14·36	8·91
Average about	31·0	95·5	13·02	8·07
Scotland, from	24·32	74·90	10·24	6·35
To	28·38	87·41	11·94	7·40
Average about	25·5	78·54	10·71	6·64
Newcastle, from	28·80	88·70	12·13	7·52
To	31·86	98·13	13·42	8·33
Average about	30·0	92·4	12·60	7·81

No. 12.

On a Bisexual Nematoid Worm which infests the common House-Fly (Musca Domestica) *in Bombay.*—By Surgeon H. J. Carter, F. R. S.

In November last (1859), while examining the head of the common House-Fly (*Musca domestica*), I noticed that two Nematoid worms came out of it, but not having time to look after them then, I deferred the subject for a future opportunity, thinking that the occurrence would be found to be frequent, and if so, that the form and origin of these worms would be worth investigating for the light it might throw on the origin of the Guinea-worm (*Filaria Medinensis*) in the human subject. Accordingly, during the month of July 1860, I have returned to the inquiry, and have observed that, on an average, about every third fly contains from two to twenty or more of these worms, which are chiefly congregated in, and confined to, the proboscis, though occasionally found among the soft tissues of the head and

posterior part of the abdomen. They are bisexual, have arrived at maturity, and are all nearly of the same size; and as they are perhaps more nearly allied to the Filaridæ than to any other family of the Nematoid worms, it seems best to place this worm, at all events for the present, in the genus *Filaria*, where, with the specific designation of "*Muscæ*," its description may stand as follows:—

Filaria Muscæ, n. sp.

Linear, cylindrical, faintly striated transversely, gradually diminishing towards the head, which is obtuse and furnished with four papillæ at a little distance from the mouth, two above and two below; diminishing also towards the tail, which is short, and terminated by a dilated round extremity covered with short spines. Mouth in the centre of the anterior extremity. Anal orifice at the root of the tail. Œsophagus commencing from a slightly dilated oral orifice, narrow at first, then becoming suddenly increased in calibre, and, after extending some distance backwards, joining the intestine, apparently without any line of demarcation, opposite the anterior termination of the hepatic organ. Intestine continued straight through the body, and nearly of the same size, on to the rectum, which is short and obliquely directed towards the anus. Œsophageal sheath commencing at the termination of the narrow portion of the œsophagus posteriorly, where the latter is embraced by the dorsal vessel, gradually increasing backwards to join, without line of demarcation, the sheath of the intestine; which, on its part, soon attaining its maximum calibre, is continued backwards, of the same size, to the termination of the hepatic organ, where it becomes slightly but suddenly reduced in diameter, and afterwards maintains nearly the same size, on to the rectum.

Hepatic organ marked by a dense white layer of oil-globules and granular matter within the intestinal sheath, surrounding the anterior third of the intestine, commencing opposite the union of the latter with the œsophagus, and terminating at the sudden diminution in diameter of the intestinal sheath, where it is defined by a circular line. Rectum more or less obscured by muscular and other structure, in the midst of which granular bodies are observed opposite its junction with the intestine. Dorsal vessel extending from the point of union between the smaller and larger portions of the œsophagus, which it embraces by bifurcation, to the posterior end of the hepatic organ, where it again appears to bifurcate, and to embrace the intestinal sheath.

Generative organs situated in the anterior part of the body, under the œsophagus and anterior part of the intestine, consisting of an ovary

and testicle opening on the right side, a little in front of the liver, by separate ducts about one-hundredth of an inch apart,—the former which is anterior, by a simple papillary aperture, and the latter by the same, but with a short funnel-shaped exsertile organ. Ovary unseen in detail, but charged with nucleated cells, and presenting a distinct line of demarcation between itself and the testicle, which on its part appears to be saccular, and also contains nucleated cells that are sometimes spermatophorous.

Spermatozoa indistinctly seen; single, in cells about 1-700th of an inch in diameter; consisting, when half-developed, of a striated, pyramidal, or triangular body growing out of a small mass of granular mucous on one side of the cell; when fully developed, apparently club-shaped.

Size.—About 1-11th of an inch long and 1-313th of an inch in its broadest diameter—that is, in the middle.

Hab.—Proboscis, head, and posterior part of the abdomen of the common House-Fly (*Musca Domestica*).

Loc.—Island of Bombay.

Observations.—The papilliferous head, transversely striated body, and general form of this worm ally it more to *Filaria Medinensis* and the microscopic free Filaridæ which I have described under the generic term of "Urolabes,"* than to any other of the Nematoid families; but, of course, the characteristic penis of the Filaridæ, both in form and position, is here absent, from the approximation of the male and female outlets of the organs of generation, which seems to be entailed by the bisexuality, (although it is not by any means apparent why it is the male organ which should be transposed,) while the latter still maintains its posterior position with respect to the former. The advancement of the vulva towards the head is not remarkable, for in *Filaria Equi* it is close to the anterior extremity.† The spermatozoon, however, more nearly resembles that of *Ascaris mystax*, both in form and development.‡ The inflated spiniferous extremity of the tail of *F. Muscæ* besides being more characteristic of the male than the female, whose tail in the Filaridæ generally is whip-like, has its resemblance in one of the free microscopic species which inhabit the salt-water drain of the town of Bombay, with this difference only, that the spines of the latter are longer, and the whole resembles more the rowel of a

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* Annals and Mag. Nat. Hist, ser. 3., Vol. iv., p. 28, July 1859.

† Blanchard: Ann. des Ss. Nat., 3 ser., t. xi., pl. 6, fig. 3*a*.

‡ Phil. Trans., 1852, pl. 26.

spur. Again, the liver is shorter, and the divisions of the alimentary canal less defined than in the free Filaridæ.

The presence of spermatozoa in these worms, together with their being all of the same size, indicates that they have arrived at maturity, and are not developed in the fly.

As above stated, I have not seen the ova in their fully-developed state, and I am ignorant of the future of this worm; but knowing that many entozoa are nursed in one animal and lay their eggs in another, it is not improbable that this part of the cycle of their development may be performed in the alimentary canal of the white "Paddy-bird" or crane, (*Ardea nigrirostis?*), which appears to live chiefly on the common house-fly, being a constant attendant for this purpose on cattle, and at the slits made in the palm-trees for the extraction of the saccharine juice.

To ascertain if *F. Muscæ* would live in sugar-and-water, in water alone, or in the former to which in one instance gum acacia had been added, and in another, a portion of gelatinized *Nostoc*, both to serve as a nidus to nestle in and for nourishment, several of these worms were transferred to these media respectively, in watch-glasses sheltered in a glass-case; but none survived more than a few hours: whether from change of habitat or change of nourishment (which latter could not be very different from that taken in by the fly, unless a secretion from the fly itself), I am ignorant.

At first I thought that I had discovered both the spermatic cells and the ova, in certain masses of cells which exist both in the lobes of the proboscis and in the head respectively of the fly, as well as about the rectum in the abdomen. But subsequent observation proved to me that these were extensions of a nucleated blastema accompanying the tracheæ, and that each cell was provided with a terminal branch of the latter. What are these cells, and what is their function? Are they at once appendages both to the tracheal and vascular systems? They differ somewhat in the lobes of the proboscis, where there are two or more groups, from those in the head, and may be easily seen in both when torn to pieces and placed under a magnifying power of 350 diameters. It seems strange that such remarkable organs should not have been figured in connection with the elements of the proboscis of the fly generally, which is one of the commonest objects of microscopical observation.

F. Muscæ will, I think, be the first bisexual Filaria of the kind on record. Schneider, however, appears to have found a true hermaphrodite one in snails, in which Filaria "spermatozoids are first seen to make their appearance in the generative tube, and then eggs; fecundation takes place, and a new generation is brought forth." Here

there appears to be a single tube which performs both functions, and of course there is no male outlet. If there be no mistake here, and the worm itself should resemble in form *Filaria Medinensis*, it will afford strong grounds for assuming that the same kind of generative process takes place in the latter. But, without desire to impugn in the least M. Schneider's assertion, I would observe that this takes place in all the free microscopic Filaridæ which I have described, (the type of which is figured in *Urolabes palustris*,*) with this exception, that the store of undeveloped spermatozoa which is always present at the upper end of the ovi-duct, close to the opening of the ovi-sac, has been introduced by the male; hence it is possible that a female Filaria in this state might be mistaken for a hermaphrodite of the description mentioned by M. Schneider.†

No. 13.

Circular from the Curator of the Grant Medical College Museum, Bombay, July 1860.

It is considered desirable that the Pathological collections of the Grant Medical College should be extended by the collection of specimens of interest; and as such specimens must be of frequent occurrence in the Hospitals and medical practice throughout the Presidency, the following Circular has been drawn up, at the suggestion of the Principal, by the Curator of the Museum of the College.

1. The collection referred to, not only serves as a *point de rapport* on subjects of pathological interest, but is an important aid in the instruction of the Native graduates and medical subordinates of the Presidency. These are reasons why medical officers might be supposed to feel an interest in the extension and completeness of the collection. Again, all the advantages, it may be remarked, which centralisation furnishes, are gained in a special degree by the collection of pathological specimens; series are then formed, which become of far more value than a larger number of isolated specimens, for every single object thus serially placed, acquires an important relation to those next it, in addition to its own intrinsic interest.

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* Annals, *loc. cit.*, pl. 2., fig. 13.

† Annals, vol. v., p. 506., June 1860.

2. All specimens of interest will be very acceptable; but, looking at the present condition of the Museum, those illustrative of the following diseases will be more especially appreciated:—

1. Tumours.
2. Dysentery (Acute and Chronic).
3. Affections of the Joints.
4. Affections of the Nervous System.
5. Affections of the Urinary System, including Calculi.
6. Hepatic affections.
7. The condition of parts affected with Leprosy.
8. That peculiar disease of the foot, now known to be produced by the growth of a *fungus*.

3. Contributors need hardly be reminded how greatly a concise and well drawn up history of the case adds to the interest of a specimen. It is only by such means that a definite knowledge of the modifications diseases undergo in tropical climates can be acquired; and this, with the investigation of new diseases, is the chief feature of interest in our professional studies.

4. With regard to the packing and mounting of specimens, besides those obvious precautions which will occur to every one, the following observations may be useful:—

First and chief, it should be remembered that specimens retain the *form* they have when first put into spirit; becoming so hardened, that it is impossible, after a short time, to distend a hollow organ or straighten a flattened part (*e. g.* a piece of intestine) which may be packed in a collapsed state, or irregularly folded. Next, as the action of spirit does not extend far below the surface, the interior parts of a thick specimen become decomposed if no precautions are taken; so that a hollow organ should be opened and distended, and a parenchymatous one be preserved in thick slices, if any internal change is to be represented, or incisions made so as to allow the spirit to reach the parts and preserve them.

As a rule, a morbid specimen should be prepared for final mounting, as far as possible, before being put into spirit.

The application of these remarks to specimens of heart disease, diseases of the bladder, uterus, joints, brain, liver, &c., it will not be difficult to see.

5. Diluted spirit, or country liquor of proportionate strength, is the best medium for preservation; but other preservative solutions are

well known, which act efficiently enough for the time. Next to alcohol the following solution is the most efficient :—

℞	Bay Salt	4 oz.
	Alum	2 oz.
	Corrosive Sublimate	4 grs.
	Boiling water	2 quarts.

To be well stirred, and the solution filtered.

Solution of *Alum* (1 to 16 of water) or Sulphate of Zinc (1 to 10 of water), adding a little camphor to prevent mouldiness; or *Naptha* in water (1 to 7 of water), all are more or less serviceable in cases of emergency.

6. Lastly, contributors may be assured that due acknowledgment will be made of all contributions; and the College will, as a matter of course, undertake to defray the expenses of packing and carriage.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS MADE AT THE BOMBAY OBSERVATORY DURING EACH MONTH OF THE YEAR 1860.

Abstract of Meteorological Observations made at the Bombay Observatory during the month of January 1860.

Date.	Standard Barometer corrected. 10 A. M.	4 P. M.	Thermometer in the Air. 6 A. M.	1 P. M.	Wet Bulb Thermometer. 6 A. M.	1 P. M.	Electrometer (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
Jan. 1			Sunday.						
,, 2	29·978	29·855	63·9	78·2	62·0	65·7	None.	None.	Cirri scattered about the sky.
,, 3	988	867	64·0	78·4	50 9	66·5	Out.	,,	Cirri and pieces of cirro-cumuli scattered about during the day-time.
,, 4	987	886	65·6	81·9	60·6	64·5	,,	,,	A few cirri in horizon; dew fell at night.
,, 5	30·028	893	64·0	79·6	61·0	67·0	,,	,,	A few cirri in horizon after 10 A. M.; dew fell at night.
,, 6	062	890	65 8	77·2	62·6	69·5	+ 9	,,	Ditto ditto ditto ditto.
,, 7	29·987	881	64·7	76·6	63·2	70·2	+ 9	,,	A few cirri in the sky during the day-time.
,, 8			Sunday.						
,, 9	30·019	890	65·5	79·9	63·0	71·4	+ 3	,,	A few cirri in S. horizon at 2 P. M.
,, 10	29·986	873	65·4	79·8	60·0	71·0	+ 9	,,	Cloudless day.
,, 11	971	866	69·7	84·2	63·3	69·0	+ 25	,,	Do.
,, 12	991	904	70·3	85·9	65·0	65·0	+ 25	,,	Cirri scattered about horizon; dew fell at night.
,, 13	30·057	933	68·3	83·6	64·5	70·0	+ 30	,,	A few cirri in E. horizon at sunrise; dew fell at night.
,, 14	063	943	67·8	78·9	64·9	69·5	+ 16	,,	Cloudless; copious dew fell at night.
,, 15			Sunday.						
,, 16	048	911	65·2	77·4	60·9	69·4	+ 4	,,	A few pieces of clouds in W. horizon at 10 A. M.; dew fell at night.
,, 17	050	913	66·8	78·9	64·1	67·0	+ 30	,,	A few cirri around horizon; dew fell at night.
,, 18	005	869	68·4	79·3	64·6	69·3	+ 25	,,	A few cirri in S. horizon at 9 A. M. and 1 P. M.; dew fell at night.
,, 19	025	887	66·0	79·8	61·0	68·6	+ 30	,,	Partially clouded with cirri; dew fell at night.
,, 20	019	915	66·6	80·2	62·2	70·2	+ 30	,,	Light cirri scattered around horizon; dew fell at night.
,, 21	047	921	68·5	78·0	67·0	70·0	+ 2	,,	Partially clouded with cirri; dew fell at night.
,, 22			Sunday.						
,, 23	080	981	69·0	75·2	65·0	65·6	+ 18	,,	Partially clouded with cirri and scud.
,, 24	049	930	60·0	76·0	52 0	62·5	+ 18	,,	A few cirri in S. horizon after 8 A. M.
,, 25	038	937	65·0	82·5	58·4	70·4	+ 19	,,	Cirri about W. horizon in the afternoon.
,, 26	044	917	66·2	80·0	61·0	71·0	+ 20	,,	A few cirri in horizon.
,, 27	004	892	66·8	80·9	60 0	70·0	+ 8	,,	Partially clouded with cirri.
,, 28	006	904	65·0	78·5	59·5	65·8	+ 4	,,	A few cirri in hor. in the afternoon.
,, 29			Sunday.						
,, 30	019	910	64·4	78·2	55·5	66·0	+ 4	,,	Cirri scattered about horizon from 9 A. M. to 9 P. M.
,, 31	003	875	63·7	77·5	55·5	65·0	+ 14	,,	A few cirri in N. horizon in the morning.
Means ..	30·021	29·517	66·3	79·4	61·0	68·0			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of February 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electro-meter (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
Feb. 1	29·972	29·857	63·4	77·2	57 5	67·4	+ 10	None.	Cloudless, with copious dew at night.
„ 2	964	839	64·0	77·6	60·0	66·6	+ 10	„	Clouded with cirri after 8 A. M.; dew fell at night.
„ 3	972	864	65·8	79·0	63·0	69·0	+ 10	„	Partially clouded with cirri; dew fell at night.
„ 4	997	848	67·0	79·2	58·0	69·0	+ 5	„	Partially clouded with cirri in the morning.
„ 5			Sunday.						
„ 6	967	843	69·5	80·4	65·0	71·6	+ 2	„	Densely clouded with cirri and cirro-cumuli.
„ 7	982	853	71·8	79·2	69·0	70·5	+ 3	„	Ditto ditto ditto.
„ 8	996	842	68·2	80·5	65·0	72·0	None.	„	Partially clouded with cirri; a lunar halo; dew fell at night.
„ 9	936	818	69·3	80·2	63·0	70·6	„	„	Cirri scattered around hor.
„ 10	940	812	68·5	80·6	65·5	71·4	„	„	Partially clouded with cirri; dew fell at night.
„ 11	929	819	70·6	82·8	63·4	73·7	„	„	Cirri scattered about hor.
„ 12			Sunday.						
„ 13	905	751	72·6	91·5	71·0	71·0	„	„	Partially clouded with cirri and cirro-cumuli; dew fell at night.
„ 14	867	751	73·7	82·6	72·0	74·3	„	„	Partially clouded with cirri and cirro cumuli; dew fell at night.
„ 15	929	822	71·8	81·2	71·0	75·0	„	„	Partially clouded with cirro-cumuli; dew fell at night.
„ 16	974	873	72·8	82·0	70·4	73·4	+ 25	„	Ditto ditto ditto before noon; dew fell at night.
„ 17	30·024	900	70·6	81·0	69·0	72·0	+ 10	„	Ditto ditto ditto ditto.
„ 18	29·978	839	71·4	83·3	67·4	72·3	+ 2	„	Partially clouded with cirri and cirro-cumuli; dew fell at night.
„ 19			Sunday.						
„ 20	877	773	72·1	83·7	68·0	70·4	None.	„	A few pieces cirro-cumuli in N. and E. hor. in the afternoon.
„ 21	877	757	72·4	84·0	66·5	76·2	+ 9	„	Cirro-cumuli scattered about the sky.
„ 22	861	747	75·2	82·7	71·0	75·0	None	„	Partially clouded with cirro cumuli in the morning.
„ 23	899	774	72·3	81·2	70·8	73·0	+ 6	„	Partially clouded with cirro-cumuli and light nimbi before noon.
„ 24	926	835	72·0	81·4	69·8	70·0	+ 1	„	Clouded with nimbi and cirro-cumuli in the day-time.
„ 25	973	832	70·8	80·2	67·7	71·0	+ 1	„	Ditto ditto in the afternoon.
„ 26			Sunday.						
„ 27	934	819	68·8	80·9	65·0	74·0	None.	„	Mist and fog in horizon in the morning; dew at night.
„ 28	961	840	70·6	84·4	69·0	73·6	+ 3	„	A few cirri in horizon in the morning and evening; dew fell at night.
„ 29	932	809	71·0	82·2	70·5	74·5	None.	„	A few cirri in horizon, dew fell at night.
Means..	29·942	29·820	70·2	81·5	66·7	71·9			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of March 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electrometer (Volta No. 1) Maximum.	Rain in Inches.	Remarks.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
Mar. 1	29·912	29·787	71·4	84·6	67·3	74·8	+ 9	None.	A few cirri in horizon in the morning.
,, 2	918	795	72·7	84·2	64·0	73·0	+ 8	,,	Ditto ditto ditto.
,, 3	857	726	72·0	84·6	68·0	74·0	None.	,,	Cloudless, with copious fall of dew at night.
,, 4			Sunday.						
,, 5	892	790	69·2	82·5	65·7	73·2	+ 4	,,	Cirri scattered about horizon after sunrise; dew fell at night.
,, 6	925	826	70·6	83·0	69·6	73·0	+ 12	,,	Cirri scattered about horizon; dew fell at night.
,, 7	905	770	70·8	81·4	72·2	74·0	None.	,,	Partially clouded with nimbi and cirri.
,, 8	869	757	73·0	82·8	70·0	72·8	,,	,,	Clouded with nimbi, moving S.E.
,, 9	880	776	73·0	82·7	71·0	72·[illegible]	,,	,,	Partially clouded with nimbi before noon; dew fell at night.
,, 10	921	800	72·2	82·6	70·0	73·2	,,	,,	Ditto ditto ditto ditto.
,, 11			Sunday.						
,, 12	933	814	73·0	83·2	71·6	75·2	None.	,,	A few cirri in E. horizon in the morning; dew fell at night.
,, 13	913	835	72·8	81·4	69·2	72·5	,,	,,	Partially clouded with cirri and cirro cumuli; dew fell at night.
,, 14	949	837	72·7	82·7	70·0	74·0	,,	,,	Densely clouded with cirri, cirro-cumuli, and fleecy clouds.
,, 15	911	780	74·3	83·9	72·7	75·0	,,	,,	Densely clouded with cirri; dew fell at night.
,, 16	905	795	74·0	84·0	71·5	74·0	,,	,,	Cirri scattered throughout the sky.
,, 17	937	808	73·2	82·8	70·0	73·4	,,	,,	Partially clouded with cirri and cirro-cumuli; dew fell at night.
,, 18			Sunday.						
,, 19	929	833	73·2	82·1	71·0	74·0	None.	,,	More or less clouded with cirro-cumuli during the day-time.
,, 20	971	855	71·4	83·0	69·7	73·2	,,	,,	Clouded with cirro-cumuli in the morning.
,, 21	940	790	72·2	85·0	70·6	76·0	,,	,,	Clear; dew fell at night.
,, 22	853	738	73·7	87·6	71·0	74·4	+ 11	,,	Ditto ditto.
,, 23	878	746	73·6	86·5	68·5	77·2	+ 25	,,	Ditto ditto.
,, 24	924	827	75·0	87·2	73·0	78·2	+ 29	,,	Ditto diito.
,, 25			Sunday.						
,, 26	920	794	77·0	87·0	76·0	78·0	None.	,,	Partially clouded with cirri and cirro-cumuli from midnight to noon; dew fell at [night.
,, 27	901	771	77·4	91·4	74·0	78·5	+ 1	,,	A few cirri along the E. horizon in the morning.
,, 28	915	810	77·2	89·5	74·0	75·5	+ 2	,,	A few cirri in the E. horizon at 2 and 3 A. M.
,, 29	903	817	75·8	87·0	73·0	78·0	None.	,,	Cloudless.
,, 30	902	787	75·0	86·0	72·0	78·4	+ 3	,,	Cloudless, with copious dew at night.
,, 31	806	764	75·8	88·5	70·0	78·0	+ 1	,,	Ditto ditto ditto.
Means..	29·909	29·904	73·4	84·7	74·2	74·9			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of April 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electro-meter (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
April 1			Sunday.						
,, 2	29·905	29·773	75·2	87·5	72·3	79·0	+ 1	None.	A few cirri along the E. horizon in the morning and evening; dew fell in the morning.
,, 3	905	782	75·2	86·4	73·0	78·2	None.	,,	Clouded with cirri and cirro-cumuli about horizon.
,, 4	892	789	76·5	86·4	73·0	76·0	+ 2	,,	Partially clouded with cirro-cumuli; dew fell at night.
,, 5	912	788	74·6	86·2	71·0	76·0	None.	,,	Ditto ditto ditto.
,, 6			Good Friday.						
,, 7	857	753	74·6	86·2	72·0	78·0	+ 25	,,	Partially clouded with cirri; dew fell after 1 A. M.
,, 8			Sunday.						
,, 9	805	659	75·6	86·8	73·5	77·8	+ 10	,,	Partially clouded with dense cirro-cumuli.
,, 10	792	671	77·1	88·0	76·0	79·0	None.	,,	Partially clouded with dense cirro-cumuli; dew fell at night.
,, 11	832	740	77·0	88·2	75·0	78·0	+ 2	,,	Partially clouded with cirro-cumuli before noon; dew fell at night.
,, 12	893	797	76·5	86·9	73·0	77·6	None.	,,	Patches of cirro-cumuli scattered about the sky at 9 & 10 A. M.; dew fell at night.
,, 13	890	801	76·6	86·6	74·0	77·7	+ 2	,,	Partially clouded with cirro-cumuli before noon.
,, 14	921	843	75·9	86·3	73·0	77·5	+ 1	,,	Ditto ditto ditto.
,, 15			Sunday.						
,, 16	925	819	78·4	86·4	75·2	77·8	+ 1	,,	Clouded with nimbi, rather densely in the morning.
,, 17	917	807	77·8	87·8	76·0	80·0	+ 70	,,	Clouded with nimbi; slight drops of rain fell in the morning.
,, 18	926	823	77·2	87·2	74·0	79·5	+ 1	,,	Clouded with cirro-cumuli before noon.
,, 19	920	815	75·6	85·8	72·5	77·1	+ 2	,,	Cirro-cumuli scattered about the horizon.
,, 20	921	753	77·5	86·9	74·5	80·2	+ 1	,,	Cirro-cumuli and fleecy clouds scattered about; lightning in E. after sunset.
,, 21	937	810	77·5	86·2	75·0	78·5	None.	,,	Cumuli in horizon, and patches of cirro-cumuli scattered about the sky; lightning in E. horizon after sunset.
,, 22			Sunday.						
,, 23	880	772	77·4	86·8	74·5	76·2	+ 24	,,	Partially clouded with nimbi and cirro-cumuli.
,, 24	887	783	77·8	87·8	74·5	77·3	None.	,,	Partially clouded with cirri and cirro-cumuli.
,, 25	893	795	77·9	86·3	75·2	78·0	,,	,,	Ditto ditto ditto.
,, 26	873	741	77·4	85·9	75·0	79·0	+ 1	,,	Clouded with cirri and cirro-cumuli; lightning in E. horizon after sunset.
,, 27	829	729	80·0	85·7	77·0	80·3	None.	,,	Ditto ditto ditto.
,, 28	847	730	79·8	83·8	76·8	78·1	,,	,,	Clouded with cirro-cumuli and nimbi; slight drops of rain at noon; lightning in E. hor. after sunset.
,, 29			Sunday.						
,, 30	857	704	78·6	87·6	77·0	79·5	,,	,,	Densely clouded with cirri and cirro-cumuli, after sunrise; lightning and thunder in E. after sunset.
Means..	29·884	29.769	76·9	86·6	74·3	78·1			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of May 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electrometer (Volta No. 1) Maximum.	Rain in Inches.	Remarks.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
May 1	29·861	29·711	80·5	89·8	78·8	81·2	Out.	None.	Clouded with cirro-cumuli, cirri, and nimbi; lightning, thunder, and rain.
,, 2	796	630	80·4	91·0	79·2	81·6	+ 2	,,	Partially clouded with cirro-cumuli.
,, 3	784	689	80·5	90·0	75·0	79·0	None.	,,	Cirri scattered about horizon.
,, 4	836	730	78·6	89·6	76·0	80·1	+ 1	,,	Partially clouded with cirri.
,, 5	804	739	78·6	88·7	76·0	80·4	+ 4	,,	Partially clouded with cirro-cumuli.
,, 6			Sunday.						
,, 7	881	757	79·6	89·2	77·1	79·8	+ 10	,,	Partially clouded with cirri, cirro-cumuli, and nimbi.
,, 8	876	765	79·8	90·4	77·1	81·0	None.	,,	Partially clouded with cirro-cumuli and nimbi.
,, 9	863	752	81·3	89·3	79·5	80·4	,,	,,	Ditto ditto ditto.
,, 10	870	758	80·6	90·2	77·8	79·0	,,	,,	Clouded with nimbi in the morning and with cirri in the afternoon; dew fell at night.
,, 11	863	758	80·1	89·9	77·1	79·2	+ 3	,,	Partially clouded with cirri, cirro-cumuli, and nimbi; dew fell at night.
,, 12	832	745	81·3	89·5	76·8	79·4	None.	,,	Partially clouded with cirri and cirro-cumuli.
,, 13			Sunday.						
,, 14	811	723	81·1	90·5	76·8	79·5	+ 5	,,	Clouded with cirro-cumuli and nimbi before noon.
,, 15	871	747	80·9	89·2	77·7	79·0	+ 2	,,	Partially clouded with cirri, cirro-cumuli, and nimbi.
,, 16	861	748	81·2	89·9	75·5	77·9	+ 15	,,	Partially clouded with nimbi.
,, 17	856	758	81·6	91·2	76·1	79·4	None.	,,	Ditto ditto.
,, 18	860	747	81·8	91·9	76·8	79·4	+ 2	,,	Partially clouded with cirri, cirro-cumuli, and nimbi; lightning in E. at night.
,, 19	863	736	81·5	89·1	77·0	79·9	None.	,,	Thunder, lightning, and light rain in the morning.
,, 20			Sunday.						
,, 21	785	690	82·4	87·9	79·5	80·7	+ 3	,,	Densely clouded with nimbi and cirro-cumuli; a few drops of rain fell in the morning.
,, 22	771	680	81·7	85·0	78·8	79·8	+ 1	,,	Densely clouded with nimbi, cirro-cumuli, and cirri.
,, 23	756	674	80·8	88·0	77·6	79·8	+ 1	,,	Cirro cumuli, cirri, and nimbi scattered about the sky; lightning in E. at night.
,, 24	782	719	81·2	88·5	77·8	80·3	None.	,,	Partially clouded with nimbi, moving S. E.
,, 25	784	694	81·7	89·6	76·8	79·1	+ 2	,,	Partially clouded with nimbi.
,, 26	757	649	82·2	91·4	79·0	81·0	+ 3	,,	Ditto a few drops of rain fell at 3 A. M. and lightning in E. observed after sunset.
,, 27			Sunday.						
,, 28	769	674	82·7	90·5	78·3	81·0	None.	,,	Ditto and a few cirri.
,, 29	774	677	82·2	91·6	78·0	81·2	,,	,,	Nimbi and cirri scattered about the sky.
,, 30	769	649	82·8	91·4	77·5	78·8	,,	,,	Partially clouded with nimbi; a few drops of rain fell at 5h. 10m. A. M.
,, 31	775	709	83·2	93·0	78·0	80·4	,,	,,	Ditto in the morning, and with nimbi and cirri in the afternoon.
Means..	29·818	29·714	84·8	89·8	77·4	79·9			

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Abstract of Meteorological Observations made at the Bombay Observatory during the month of June 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electrometer (Volta No. 1) Maximum.	Rain in Inches.	Remarks.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
June 1	29·800	29·696	83·7	92·2	80·0	81·0	+ 6	0·06	Partially clouded with cirri and nimbi.
„ 2	811	709	84·0	93·0	81·0	82·0	+ 5	None.	Clouded with nimbi and cirri, but rather densely after sunset; lightning, thunder, and rain.
„ 3			Sunday.						
„ 4	748	643	82·8	90·5	80·0	81·0	Out.	0·06	Clouded with cirri, cirro-cumuli, and nimbi; lightning, thunder, and rain.
„ 5	754	617	83·6	92·4	80·0	82·0	+ 1	None.	Clouded with cirri, cirro-cumuli, and nimbi; lightning in N.E.
„ 6	702	606	83·4	91·8	80·8	83·0	Out.	„	Clouded with nimbi, cirri, and cirro-cumuli; lightning, thunder, and rain.
„ 7	677	581	83·8	89·8	81·0	82·5	None.	„	Densely clouded; lightning and thunder after sunset.
„ 8	657	513	80·7	92·0	76·2	84·0	Out.	„	Ditto ditto ditto.
„ 9	607	513	79·7	91·0	76·3	81·0	+ 1	2·28	Ditto ditto ditto.
„ 10			Sunday.						
„ 11	589	466	78·0	85·2	77·0	80·2	Out.	1·18	Densely clouded; lightning, thunder, and rain.
„ 12	518	459	79·6	88·5	78·3	83·0	„	1·43	Ditto ditto.
„ 13	581	521	78·0	78·8	78·0	78·4	„	7·31	Ditto ditto.
„ 14	585	552	80·2	80·1	80·0	78·5	+ 40	2·54	Overcast with nimbi; light rain.
„ 15	664	594	80·5	87·8	79·5	82·8	None.	0·08	Ditto ditto.
„ 16	647	597	82·3	88·8	80·0	82·8	+ 4	0·22	Densely clouded with nimbi; shower of rain at midnight.
„ 17			Sunday.						
„ 18	682	626	82·5	91·0	81·0	84·0	+ 5	None.	Partially clouded with nimbi and cirro-cumuli; light shower of rain at 11-30 P. M.
„ 19	718	637	82·0	90·5	80·0	84·0	+ 3	0·01	Partially clouded with cirri, cirro-cumuli, and nimbi.
„ 20	715	654	82·0	84·7	79·0	80·1	Out.	1·43	Partially clouded; lightning, thunder, and rain.
„ 21	684	595	77·9	84·0	77·3	80·0	None.	0·21	Overcast, lightning and light rain.
„ 22	657	614	76·0	86·0	75 0	80·8	Out.	1·60	Densely clouded; lightning, thunder, and rain,
„ 23	708	666	78·6	86·6	77·5	80·7	None.	0·01	Ditto with nimbi; light rain at midnight.
„ 24			Sunday.						
„ 25	762	712	81·0	88·3	79·0	82·0	+ 12	0·07	Clouded, with cirri, cirro-cumuli, and nimbi; light rain.
„ 26	714	648	83·0	89·0	78·5	81·0	None.	None.	Clouded as on the last day; light drops of rain at 3 P. M.
„ 27	733	678	81·8	85·2	78·4	78·2	Out.	0·24	Partially clouded, with cirri, cirro-cumuli, and nimbi; light rain.
„ 28	754	700	81·4	89·5	79·0	82·0	+ 2	0·27	Ditto ditto ditto.
„ 29	720	670	82·0	79·0	80·0	77·0	Out.	1·82	Densely clouded with cirri, cirro-cumuli, and nimbi; lightning, thunder, and rain, at 3 A. M.
„ 30	702	608	76·6	81·3	76·0	78·3	„	0·89	Overcast with nimbi; occasional showers of rain.
Means..	29·688	29·610	80·9	87·5	77·2	81·1			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of July 1860.

Date.	Standard Barometer corrected. 10 A. M.	4 P. M.	Thermometer in the Air. 6 A. M.	1 P. M.	Wet Bulb Thermometer. 6 A. M.	1 P. M.	Electrometer (Volta No. 1) Maximum.	Rain in Inches.	Remarks.
July 1			Sunday.					1·96	
,, 2	29·579	29·496	78·0	81·2	78·0	79·0	None.	0·76	Densely clouded with nimbi; showers of rain now and then.
,, 3	555	498	78·3	81·0	77·5	80·0	+ 4	0·24	Overcast with nimbi ; light rain after sunrise.
,, 4	572	512	78·8	83·8	78·0	82·0	None.	0·29	Overcast; light rain after 5 A. M.; lightning and thunder at 11 P. M.
,, 5	606	561	80·4	86·5	79·4	82·5	+ 20	0·27	Densely clouded; light showers of rain.
,, 6	691	620	78·4	78·4	77·2	78·0	+ 50	1·42	Overcast; smart showers of rain.
,, 7	697	641	80·0	83·4	79·2	81·0	+ 20	0·84	Ditto ditto.
,, 8			Sunday.					4·17	
,, 9	736	669	78·6	77·8	78·2	77·8	+ 25	2·51	Overcast with nimbi; smart showers of rain.
,, 10	726	676	79·0	80·8	77·6	79·7	None.	0·24	Overcast with nimbi ; light rain ; lightning in E. at 1 A. M.
,, 11	718	634	79·8	83·5	79·0	81·0	,,	0·10	Clouded with nimbi, cirro-cumuli, and cirri ; light rain in the morning.
,, 12	703	621	79·5	87·5	77·2	81·1	,,	0·01	Clouded as on the day before; drizzling rain at 8 P. M.
,, 13	711	637	81·3	88·2	79·0	82·0	,,	None.	Partially clouded with nimbi, cirro-cumuli, and cirri; a few drops of rain at 10 A. M.
,, 14	689	596	81·8	87·4	79·0	81·0	,,	0·16	
,, 15			Sunday.					0·12	Densely clouded; rain in the evening.
,, 16	630	567	79·4	79·2	78·3	77·8	,,	2·42	Densely clouded with nimbi and cirro-cumuli; light rain.
,, 17	654	573	80·0	81·9	77·5	78·5	,,	0·06	Densely clouded, with nimbi and cirro-cumuli ; light rain at 7 P. M.
,, 18	687	603	79·4	84·2	77·2	82·2	,,	0·32	Densely clouded ; light rain at noon and after 10 P. M.
,, 19	687	622	75·4	79·8	73·2	78·8	,,	3·06	Densely clouded ; heavy showers of rain.
,, 20	684	603	77·2	78·0	77·0	77·5	,,	1·52	Densely clouded ; light showers of rain.
,, 21	660	598	79·3	84·3	78·4	79·6	,,	0·63	Densely clouded ; passing showers of rain.
,, 22			Sunday.					0·07	
,, 23	654	591	80·2	84·5	77·8	80·5	,,	0·46	Densely clouded with nimbi and cirro-cumuli ; light rain.
,, 24	671	604	80·8	84·5	79·0	80·5	,,	0·10	Overcast with nimbi ; passing showers of rain.
,, 25	641	578	80·6	85·7	78·2	81·0	,,	0·04	Densely clouded with nimbi and cirro cumuli ; light rain in the afternoon.
,, 26	653	591	80·6	85·8	78·5	81·0	,,	None.	Densely clouded with nimbi and cirro-cumuli ; a few drops of rain at 5h. 45m. [P. M.
,, 27	662	601	80·7	86·2	78·7	81·2	,,	0·09	Nearly overcast ; light rain at 5¼ P. M.
,, 28	673	629	78·3	86·2	77·0	81·5	,,	0·31	Clouded with nimbi and dense cirro-cumuli ; light rain in the morning.
,, 29			Sunday.					None.	
,, 30	674	596	80·1	84·0	78·5	80·5	,,	0·01	Densely clouded with nimbi; drizzling rain.
,, 31	690	617	80·2	85·5	78·2	81·0	,,	None.	Densely clouded with nimbi and cirro-cumuli.
Means..	29·665	29·597	79·4	83·4	70·2	80·2			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of August 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electrometer (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
Aug. 1	29·718	29·670	80·2	80·8	79·0	77·6	None.	0 53	Densely clouded with nimbi ; light rain in the morning.
,, 2	730	642	97·6	80·0	77·5	76·4	,,	0·19	Densely clouded with nimbi ; light rain after 8 A. M.
,, 3	675	603	78·4	82·9	77·0	79·8	,,	0·19	Overcast ; light rain before sunrise and after 3 P. M.
,, 4	680	640	79·6	83·2	78·0	80·0	,,	0·08	Densely clouded ; rain in the morning.
,, 5			Sunday.					0·10	
,, 6	705	637	78.4	84·0	77·0	79·0	,,	1·21	Densely clouded with nimbi; passing showers of rain after sunset.
,, 7	697	596	79·0	84·4	77·0	80·0	,,	0·42	Ditto ditto passing showers of rain.
,, 8	649	593	77·9	82·4	77·0	79·8	,,	0·53	Ditto ditto light rain in the morning.
,, 9	702	673	77·3	84·8	77·0	79 8	,,	0·89	Clouded with nimbi and cirro-cumuli ; showers of rain now and then.
,, 10	821	744	78·8	85·0	77·5	80·0	,,	0·41	Ditto ditto passing showers of rain now and then.
,, 11	777	694	78·6	85·0	77·0	81·0	,,	0·10	Ditto ditto passing showers of rain in the morning.
,, 12			Sunday.					0·02	
,, 13	714	662	79·5	82·7	77·3	78·0	,,	0·32	Densely clouded with nimbi ; smart showers of rain.
,, 14	725	657	79·7	81·6	77·7	79·2	,,	0·03	Overcast with nimbi ; drizzling rain at 7 and 11 A. M.
,, 15	765	684	77·2	82·6	76·0	78·3	,,	0·14	Densely clouded with nimbi and cirro-cumuli ; light rain.
,, 16	759	670	77·6	84·2	77·0	79·4	,,	0·29	Ditto ditto ditto.
,, 17	714	628	79·0	77·9	77·5	76·0	,,	0 83	Nearly overcast with nimbi ; light showers of rain.
,, 18	685	640	76 0	82·2	76·0	79·3	,,	0·37	Overcast with nimbi ; showers of rain in the morning.
,, 19			Sunday.					0·01	
,, 20	856	772	77·6	86·2	76·5	80·2	,,	0·04	Clouded with nimbi ; light rain in the morning.
,, 21	839	748	78·0	85·0	76·0	79·0	,,	None.	Partly clouded with nimbi and cirro-cumuli ; light rain in the morning.
,, 22	788	721	79·5	85·6	76·9	79·5	,,	0·09	Ditto ditto ditto ditto
,, 23	806	744	79·5	84·8	76·5	81·0	,,	0·18	Clouded with nimbi ; passing rain in the morning.
,, 24	819	752	79·3	83 6	76·0	77·2	,,	None.	Nimbi, cirri, and cirro-cumuli scattered about the sky ; lunar halo.
,, 25	839	766	78·7	87·3	76·0	80·0		,,	Nimbi and cirro-cumuli in the sky ; lunar halo.
,, 26			Sunday.				,,	,,	
,, 27	889	792	79·0	86·1	76·5	80·0	,,	,,	Partially clouded with nimbi and cirro-cumuli.
,, 28	876	769	80·6	86·8	77·0	79 2	,,	,,	Densely clouded with nimbi, cirro-cumuli, and cirri.
,, 29	847	719	79·4	85·4	77·5	78·5	,,	0·05	Densely clouded ; light rain at 7½ A. M. ; a lunar halo. [5h. 54m. A. M.
,, 30	825	698	78·8	86·2	77·3	79·0	,,	0·01	Partially clouded with cirri, cirro-cumuli, and nimbi ; a passing shower of rain at
,, 31	825	716	79·4	86·0	77·0	78·6	,,	None.	Partially clouded ; no measurable rain ; a rainbow in W.
Means..	29·767	29·689	79·8	83·9	76 9	79·0			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of September 1860.

Date.	Standard Barometer corrected. 10 A. M.	Standard Barometer corrected. 4 P. M.	Thermometer in the Air. 6 A. M.	Thermometer in the Air. 1 P. M.	Wet Bulb Thermometer. 6 A. M.	Wet Bulb Thermometer. 1 P. M.	Electrometer (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
Sept. 1	29·810	29·690	79·8	88·3	76·3	80·0	None.	None.	Clouded with nimbi, cirri, and cirro-cumuli.
,, 2			Sunday.						
,, 3	736	650	79·1	84·8	76·0	79·0	,,	0·24	Densely clouded with cirri, cirro-cumuli, and nimbi; light rain; lunar halo.
,, 4	714	612	76·7	78·0	76·0	77·5	,,	1·09	Overcast; showers of rain now and then.
,, 5	682	595	76·0	81·3	75·8	78·8	+30	3·25	Overcast; smart showers of rain; lightning in E at night.
,, 6	658	604	77·2	78·8	76·5	77·5	+20	1·24	Overcast; smart showers of rain; lightning and thunder.
,, 7	696	629	77·2	80·6	76·4	80·0	None.	0·93	Densely clouded with cirri, cirro-cumuli, and nimbi; light rain.
,, 8	692	624	80·2	82·6	78·5	79·2	,,	0·17	Ditto ditto ditto.
,, 9			Sunday.					0·13	
,, 10	826	760	79·6	84·6	77·5	78·8	,,	0·01	Ditto ditto ditto; light rain at 9h. 23m. P. M.
,, 11	865	774	78·6	79·6	76·5	78·0	,,	0·14	Clouded as on the last day; light rain in the morning and at noon.
,, 12	842	753	78·0	85·6	77·0	79·2	+10	None.	Partially clouded with cirri, cirro-cumuli, and nimbi.
,, 13	852	736	79·2	85·0	76·5	79·0	+30	,,	Ditto ditto light drizzling rain at 9 P. M.
,, 14	815	737	79·5	84·9	77·0	79·2	None.	,,	Densely clouded with cirri, cirro-cumuli, and nimbi.
,, 15	776	703	79·8	85·2	77·5	79·2	,,	0·03	Densely clouded; drizzling rain between 7h. 54m. and 8h. 57m. P. M.
,, 16			Sunday.					None.	
,, 17	752	677	79·4	87·6	76·5	80·0	,,	,,	Clouded with cirri, cirro-cumuli, and nimbi.
,, 18	741	674	79·2	85·3	76·5	81·0	,,	0·08	Clouded as before; light rain at 7 P. M.
,, 19	758	705	79·0	87·6	76·5	80·0	,,	None.	Partially clouded; drizzling rain at 8 P. M.
,, 20	826	743	78·2	87·0	77·2	80·0	,,	,,	Partially clouded; a few drops of rain at 8 A. M. and 2 P. M.
,, 21	844	798	78·8	87·6	76·0	79·5	,,	0·01	Partially clouded with cirri and nimbi; drizzling rain at 1-30 P. M.
,, 22	859	780	77·4	87·9	75·0	78·5	,,	None.	Ditto ditto a few drops of rain before noon.
,, 23			Sunday.					,,	
,, 24	859	757	77·8	87·0	76·0	79·0	,,	,,	Partially clouded with nimbi.
,, 25	846	743	77·6	86·3	76·0	77·5	,,	,,	Partially clouded with nimbi, and cirri, and cirro-cumuli.
,, 26	800	678	79·2	87·2	76·2	79·5	,,	0·09	Densely clouded with nimbi, cirri, and cirro-cumuli; lightning, thunder and rain.
,, 27	739	617	77·6	86·2	77·0	80·2	+20	0·74	Ditto ditto ditto ditto.
,, 28	734	621	79·0	88·6	77·6	82·6	+20	None.	Cirri, cirro-cumuli, and nimbi scattered about; lightning, thunder, and a few drops of rain.
,, 29	755	677	79·7	82·4	78·5	79·5	+2	,,	Ditto ditto ditto ditto.
,, 30			Sunday.						
Means..	29·734	29·693	75·7	84·7	76·6	79·3			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of October 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electro-meter (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
Oct. 1	29·840	29·731	80·4	88·8	79·0	82·0	None.	None.	Partially clouded with cirri, cirro-cumuli, and nimbi; a lunar halo at 10 P. M.
,, 2	836	750	80·9	88·0	78·2	80·5	,,	,,	Clouded as before; a few drops of rain at 11-24 P. M.
,, 3	852	756	79·4	87·8	77·4	80·0	,,	,,	Ditto ditto lightning in S. E.; drizzling rain.
,, 4	917	808	76·5	83·2	74·5	78·0	,,	0·10	Densely clouded; light rain in the morning.
,, 5	925	833	78·2	85·0	76 0	78·3	,,	0·96	Partially clouded; heavy rain at 8 A. M.
,, 6	952	852	77·8	87 3	76·2	78·5	,,	None.	Partially clouded with nimbi and cirri.
,, 7			Sunday.						
,, 8	953	877	79·7	87·2	77·8	80·5	,,	,,	Densely clouded with cirri, cirro-cumuli and nimbi; lightning at night; lunar halo; rainbow in E.
,, 9	937	804	79·4	87·6	78·0	81·0	,,	,,	Partially clouded with cirri, cirro-cumuli, and nimbi; dew fell at night.
,, 10	843	730	79·6	87·5	78·6	81·3	,,	,,	Partially clouded with cirro-cumuli; dew fell at night.
,, 11	805	683	86·0	91·8	78·5	78·0	,,	,,	Partially clouded with nimbi and cirro-cumuli; lightning in N. E. after sunset.
,, 12	823	732	80·5	89·6	77·2	80·5	,,	,,	Ditto ditto; dew fell at night.
,, 13	856	753	80·2	89·2	79·0	82·0	,,	,,	Partially clouded with cirri and cirro-cumuli; lightning in N. E. horizon.
,, 14			Sunday.						
,, 15	836	734	79·6	90·0	77·0	83·0	Out.	,,	Partially clouded; lightning, thunder, and rainbow.
,, 16	812	692	80·4	88·8	77·4	81·5	,,	0·25	Densely clouded; lightning, thunder, and rain.
,, 17	809	703	78·5	87·5	74·2	80·0	+ 12	0·15	Ditto ditto.
,, 18	856	720	80·0	88·7	77·6	80·0	+ 50	0·08	Ditto ditto.
,, 19	860	762	78·9	89·0	78·0	83·0	Out.	0·62	Ditto ditto.
,, 20	875	756	77·7	84·4	77·0	80·0	+ 2	0·01	Densely clouded with nimbi and cirro-cumuli; lightning in S.; passing shower of rain.
,, 21			Sunday.						
,, 22	883	748	78·5	87·1	77·4	77·7	None.	None.	Clouded with cirri and cirro-cumuli; dew at night.
,, 23	844	713	79·9	89·1	78·2	81·6	,,	,,	Ditto ditto ditto.
,, 24	834	712	80·0	91·1	79·0	81·5	,,	,,	Partially clouded with cirri and cirro-cumuli; dew fell in the morning; lightning after sunset.
,, 25	866	756	80·8	89·0	79·0	82·0	,,	,,	Partially clouded; lightning from midnight to 6 A. M.
,, 26	848	733	79·6	90·8	78·0	83·5	,,	,,	Partially clouded; lightning and dew fell at night.
,, 27	832	725	80·8	90·0	79.0	82·3	,,	0·33	Partially clouded with cirri and cirro-cumuli; lightning at night.
,, 28			Sunday.						
,, 29	853	763	80·2	89·4	79·0	81·8	+ 1	None.	Partially clouded with cirri, cirro-cumuli, and nimbi; dew fell at night.
,, 30	877	783	80·0	87·4	79·0	78·0	None.	,,	Ditto ditto ditto.
,, 31	885	774	77·5	88·0	75·4	76·0	+ 4	,,	A few clouds about hor. in the morning and evening; dew fell at night.
Means..	29·818	29·752	79·0	88·2	77·6	80·4			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of November 1860.

Date.	Standard Barometer. corrected. 10 A. M.	4 P. M.	Thermometer in the Air. 6 A. M.	1 P. M.	Wet Bulb Thermometer. 6 A. M.	1 P. M.	Electro-meter (Volta No. 1) Maximum.	Rain in Inches.	REMARKS.
Nov. 1	29·896	29·771	77·0	87·2	75·0	77·0	None.	None.	A few clouds about hor. in the morning and evening ; dew fell at night.
,, 2	882	767	76·3	88·0	74·0	75·0	,,	,,	Ditto ditto ditto.
,, 3	897	773	74·2	89·9	68·0	75·0	,,	,,	Cloudless.
,, 4			Sunday.						
,, 5	977	872	75·3	89·6	72·0	76·5	,,	,,	Mist in horizon in the morning ; dew fell at night.
,, 6	969	866	75·5	89·8	69·5	70·3	+ 5	,,	Mist along the W. horizon in the morning.
,, 7	995	871	73·4	87·6	66·5	67·0	+ 2	,,	Mist in horizon in the morning ; fresh breezes of wind at 7 P. M.
,, 8	30·021	904	71·4	85·4	64·0	68·0	+ 9	,,	Mist and fog in horizon in the morning.
,, 9	021	904	71·0	86·8	67·5	66·2	+ 1	,,	Mist in horizon in the morning ; dew fell at night.
,, 10	020	917	70·8	86·2	65·0	73·2	None.	,,	Ditto ditto ditto.
,, 11			Sunday.						
,, 12	026	906	71·5	84·0	67·9	71·0	,,	,,	Mist in horizon in the morning ; dew fell at night.
,, 13	019	904	70·6	86·8	66·6	70·6	,,	,,	Ditto ditto ditto.
,, 14	012	877	70·8	86·4	66·5	71·2	+ 2	,,	Ditto ditto ditto.
,, 15	29·983	839	70·2	87·0	66·5	72·0	+ 35	,,	Ditto ditto ditto.
,, 16	948	843	70·8	86·3	64·5	66·0	+ 2	,,	Ditto ditto ditto.
,, 17	959	835	69·8	85·8	65·7	70·0	+ 5	,,	Cirri scattered about horizon in the evening.
,, 18			Sunday.						
,, 19	919	797	70·4	83·5	67·0	73·0	None.	,,	Cloudless.
,, 20	925	826	71·0	85·2	62·1	73·0	,,	,,	Partially clouded with cirro-cumuli afternoon.
,, 21	969	849	72·6	86·6	67·0	75·0	+ 3	,,	Partially clouded with cirro-cumuli.
,, 22	945	846	73·8	88·8	70·0	77·5	+ 1	,,	Cirro-cumuli scattered about the sky.
,, 23	973	877	75·4	88·0	71·0	74·4	+ 1	,,	Densely clouded with cirro-cumuli ; dew fell at night.
,, 24	30·001	922	76·0	88·2	70·0	76·5	+ 4	,,	Cirro-cumuli scattered about the sky.
,, 25			Sunday.						
,, 26	009	910	73·8	84·4	70·0	73·5	None.	,,	Partially clouded with cirro-cumuli.
,, 27	061	937	73·8	88·4	64·0	71·4	+ 6	,,	Partially clouded with cirri afternoon ; dew fell at night.
,, 28	085	958	72·6	85·2	63·0	67·5	+ 16	,,	Partially clouded with cirri.
,, 29	041	921	72·2	86·2	68·0	69·0	+ 30	,,	Partially clouded with cirri ; lunar halo at night.
,, 30	042	904	69·6	85·6	66·6	72·8	+ 4	,,	Cirri scattered around horizon.
Means..	29·980	29·907	72·6	86·8	67·6	72·0			

Abstract of Meteorological Observations made at the Bombay Observatory during the month of December 1860.

Date.	Standard Barometer corrected.		Thermometer in the Air.		Wet Bulb Thermometer.		Electro-meter (Volta No. 1) Maximum.	Rain in Inches.	Remarks.
	10 A. M.	4 P. M.	6 A. M.	1 P. M.	6 A. M.	1 P. M.			
Dec. 1	30·024	29·868	68·2	84·8	66·2	73·0	+ 30	None.	A few cirri scattered here and there; dew fell at night.
,, 2			Sunday.						
,, 3	29·932	823	69·8	86·6	67·0	72·0	+ 16	,,	Cloudless, with copious fall of dew at night.
,, 4	947	838	71·0	85·6	68·0	73·0	+ 1	,,	Clouded around hor. with light cirri; dew fell at night.
,, 5	966	873	70·0	87·2	66·6	72·2	+ 12	,,	A few cirri along the Eastern horizon in the morning; dew fell at night.
,, 6	940	800	68·0	85·5	66·0	70·6	+ 40	,,	Cloudless, with copious fall of dew at night.
,, 7	915	804	71·0	87·6	66·0	69·0	+ 12	,,	Ditto ditto ditto.
,, 8	921	813	70·8	89·3	67·0	69·7	+ 20	,,	Ditto ditto ditto.
,, 9			Sunday.						
,, 10	943	863	73·6	88.8	66·5	71 0	+ 4	,,	A few cirri in horizon during the day; dew fell at night.
,, 11	961	864	71·6	88.4	67·0	72·0	+ 2	,,	A few cirri scattered about horizon after 1 P. M.; do. do.
,, 12	945	853	71·3	86.6	67·3	71·4	+ 2	,,	A few cirri scattered about horizon in the morning, do. do.
,, 13	922	847	74·2	81.2	71·8	69·2	+ 8	,,	Partially clouded with cirri and cirro-cumuli; lightning in N.N.W. at 10 P. M.
,, 14	929	827	70·8	81.0	66·0	70·0	+ 2	,,	Partially clouded with cirro-cumuli.
,, 15	973	875	71·4	82.0	69·0	71·0	+ 1	,,	Partially clouded with cirri and cirro-cumuli; dew fell in the morning.
,, 16			Sunday.						
,, 17	979	872	72·6	83·8	68·8	76·0	+ 5	,,	Partially clouded with cirri and cirro-cumuli; dew fell at night.
,, 18	950	872	73·0	83·4	71·0	73·4	+ 2	,,	Cirro-cumuli scattered throughout the sky after sunrise; lightning in E. horizon.
,, 19	969	880	75·2	87·0	69·0	74·0	None.	,,	Do. do. do. do. do. do do.
,, 20	30·016	918	72·8	88·2	68·0	72·5	+ 2	,,	A few patches of cirro-cumuli scattered around horizon; dew fell at night.
,, 21	037	943	74·0	88·4	70·0	71·4	None.	,,	Cirro-cumuli scattered around horizon after noon; dew fell at night.
,, 22	050	931	72·6	86·0	67·5	74·5	+ 10	,,	Cirro-cumuli scattered about in the morning.
,, 23			Sunday.						
,, 24	058	933	71·2	88·2	68·2	70·2	+ 1	,,	Cloudless sky, with slight dew at night.
,, 25			Christmas Day.						
,, 26	015	909	71·0	86·1	67·0	72·5	+ 2	,,	A cloudless day.
,, 27	002	900	70·4	86·9	66·0	72·0	+ 10	,,	A few cirri in hor. after sunset, and dew in the morning.
,, 28	29.975	884	70·6	83·7	64·6	72·0	+ 2	,,	Partially clouded with cirri.
,, 29	985	898	70·8	86·7	67·0	72·5	Out.	,,	Partially clouded with cirri and cirro-cumuli.
,, 30			Sunday.						
,, 31	30·034	941	72·8	86·0	69·0	73·0	None.	,,	Densely clouded with cirri; lightning in N.E. horizon after sunset.
Means..	29·975	29·872	71·1	85·9	67·6	71·9			

ABSTRACT PROCEEDINGS

OF THE

MEETINGS OF THE MEDICAL AND PHYSICAL SOCIETY,

FOR THE YEAR 1860.

No. 1.

MONTHLY MEETING HELD 4TH FEBRUARY 1860.

Present :

A. H. Leith, M.D. *President,* in the Chair; H. J. Carter, Esq., F.R.S.; J. Peet, M.D., *Vice-Presidents.*

Members :—J. W. Winchester, LL.D.; H. D. Glasse, Esq.; W. Campbell, M.D.; R. Haines, M.B.; G. C. M. Birdwood, M.D.; R. Boxwell, M.D.; H. V. Carter, M.D.; and W. C. Coles, M.D., *Secretary.*

The minutes of the last monthly meeting, held on the 3rd December 1859, were read and confirmed. In accordance with the 12th Regulation, the following Medical men of celebrity, not residing in India, were elected Honorary Members of the Society to fill vacancies:—T. Watson, M.D., F.R.S., London; J. Copland, M.D., F.R.S., London; W. Ferguson, Esq., F.R.S., London; R. Todd, M.D., F.R.S., London; and Sir C. Locock, M.D., F.R.S., London.

Letters were read from several subscribers on the business of the Society, and from the Superintendent of the Government Observatory (letter No. 22 of the 1st February 1860), forwarding the last published volume of the Magnetical and Meteorological Observations for the year 1858, presented by Government.

The first communication brought before the meeting was from Dr. Lownds, Surgeon, Rajpootana Agency, viz: "Remarks on the rational Treatment of Cholera." In this elaborate and interesting paper the author enters very fully into the subject of cholera; traces its causes,

elucidates its pathology, and dwells upon the effects of the poison as capable of being advantageously studied in the four stages of the disease, and suggests in each an appropriate and rational treatment. As the paper will probably be hereafter published,* it is not noticed further, than to remark that in the stage of collapse, Dr. Lownds has used with advantage, oxygenated drinks, and the form adopted by him in the epidemic of 1857, in Bombay, was to supply the patients freely with water saturated with *nitrous oxide* gas. The turn the discussion took on Dr. Lownds' paper, was on the pathological views expressed by the author, and upon the use of calomel in any stage of the disease.

A very interesting description of a rare disease of the hair by Dr. McDowall was then read, and it was accompanied by drawings and preparations illustrative of the disease. Dr. McDowall considers the affections closely allied to a disease which is rarely seen out of Poland, termed "Plica Polonica." The Meeting considered his views to be quite correct, as it appears to be a disease of the cuticular cells of the hair, which also involves the outer ones of the cortical layer, but does not extend into the medullary cells. The diseased cells mentioned, pour forth a serous secretion, somewhat like that discharged from the epithelial cells of the skin when affected with eczema, and the linear cells of the cortical layer adhere so strongly in this, that when the hair is soaked in a strong solution of potash and drawn out from between the nails of the finger and thumb exerting a little pressure on it at the same time, the excretion together with the disorganized cuticular cells and the outer ones of the cortical layer, come off in a sheath altogether, or in shreds, leaving the rest of the cortical layer and the medullary cells intact, so that the disease is thus limited, as above-stated, to this part of the hair. It might be almost considered eczema of the hair chiefly confined to the lower part. The hairs thus affected are more or less rough and irregular on their surface, and the incrustation in some specimens so accumulated as to give it a knotty character, through which the hair may be seen to pass defined and unbroken.

Dr. Birdwood placed upon the table a specimen of "Narrayen" Oil, which when pure, is alleged to possess a singular power of passing through certain otherwise impenetrable substances unchanged; and Dr. Birdwood detailed an instance in which he had been a witness of its remarkable properties. He also showed a specimen of "Gram Vinegar" or dew obtained from gram whilst growing, supposed to be a weak solution of "Formic Acid."

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* See page 247 *ante*.

The Secretary announced that the 5th Volume of the Transactions would be issued from the Press during the present month, and after the best thanks of the Society had been accorded to the contributors, the Meeting was adjourned to Saturday, 3rd March 1860.

No. 2.

MONTHLY MEETING HELD 10TH MARCH 1860.

Present :

A. H. Leith, M.D., *President*, in the Chair; H. J. Carter, Esq., F.R.S., and J. Peet, M.D., *Vice-Presidents*.

Members:—J. W. Winchester, LL.D.; W. Arbuckle, M.D.; H. D. Glasse, Esq.; R. Haines, M.B.; W. G. Hunter, Esq.; G. C. M. Birdwood, M.D.; R. Boxwell, M.B.; H. V. Carter, M.D.; and W. C. Coles, M.D., *Secretary*.

The proceedings of the Meeting held on the 4th February were read and confirmed.

T. G. Hewlett, Esq., Acting Civil Surgeon, Rajcote, was duly elected a member of the Society under Regulation V., and Assistant Surgeon A. N. Hojel, for two years, under Regulation VII., on admission into the service.

Letters were read from Assistant Surgeons Thorold and Colston intimating the transmission of their subscriptions.

The 5th Volume of the new series of the Society's Transactions was announced as in course of distribution to members.

The first communication was from Dr. Faye, Professor of Medicine in the University of Norway, relating to the effects of mercury when given to parents upon their offspring. The enquiries were considered by the meeting to possess much interest, and the replies of members were requested to be sent to Dr. H. Moore, Saville Street, Dublin, who has kindly consented to communicate them to Dr. Faye.

A topographical and geological sketch of the Province of Sarawan, or northern portion of the table-land of Beloochistan, by Assistant Surgeon Cook, was then read. As the paper will probably hereafter appear in the Transactions* of the Society, a short abstract is only now furnished.

Dr. Cook commences his sketch by giving a general outline of the geographical features of the territories under the Khan of Kelat. These territories would appear to extend in a direct line from Quetta

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* See page 1 *ante*.

in the north, to Cape Monze, near Kurrachee, in the south; and from the province of Mekran, to the Murree and Boogtee Hills near the confluence of the Indus in the east; thus occupying all that part on the western side of the Indus called Beloochistan.

It is, however, to the province of Sarawan, which extends from Quetta to Kelat, and through which the two great roads from Afghanistan to Western India by the Bolan Pass and Kelat branch off, at Quetta, that Dr. Cook specially calls attention, having, as he states, had the good fortune of seeing these districts throughout. The principal valleys of Sarawan are minutely described by the author. In the valley of Quetta or Shawl, the mean temperature of the day in June was 79° Fahrenheit, whilst that of the night was 69°. Here the *dandelion, trefoil, clover,* and *lavender* were seen, and the *fauna* and *flora* begin to approach those of England. In the valley of Mustoong, which is the most famous for fruit, there are five distinct sorts of grapes, and orchards of apple trees, apricots, peaches, &c. in great abundance. The geography, agriculture, products, &c. of all the valleys are described, especially those of Kelat. The town of Kelat is situated in 29°, and the valley is about 7,000 feet above the level of the sea. It is abundantly watered by a stream about eight feet wide, which, fringed with "the white and weeping willows" winds throughout its whole extent. The town is built on a hill in terraces, overhanging which is the fort or palace of the Khan, of which Dr. Cook states:—"It is an imposing and antique structure, probably the most ancient edifice in Beloochistan, owing its foundation to the Hindoo kings who preceded the Mahomedan dynasty. From its durbar-room, which has an open balcony, a most extensive view is obtained, commanding the whole valley." Many of the inhabitants, including the Khan and his court, leave the valley of Kelat in October when the winter begins, and adjourn to Gundava, where they await the return of summer. Firewood is furnished from a species of juniper, with which the mountains are covered. The author enters into the history and origin of the principal tribes of Kelat with considerable detail, and regarding the chief and most numerous tribe, the Brahooees, he observes:—"I am certainly inclined to adopt the opinion, that they were driven out of India by the invading host of the Aryas from the north-west, but probably not before they had adopted the Hindoo religion, which subsequently was exchanged for the Mahomedan." The Beloochees and Merdoee are also described, and among the features of the society pertaining to feudal times in these parts, is an interesting description of the wandering Bards who pervade the

country, and who, on warlike occasions, incite, by their songs alone, to arms and deeds of valour, the wild hordes of the mountain chiefs, dependents on the Khan of Kelat.

Lastly, Dr. Cook describes the geology, chiefly of the valleys of Kelat and Rodingo, which are only separated from each other by a ridge of low hills. In both these valleys he has established the existence of a series of clays, shales, and limestone-strata, which, from their containing *Orthoceratites*, *Ammonites*, and *Belemnites*, are evidently Sub-Jurassic. The series too, appears to have been much intruded and disturbed by volcanic rocks, from the chertified state of many of the strata and the presence of dioritic and old mica-bearing traps among them. Over this series again, lie nummulitic strata, but no oolitic or cretaceous ones appear to have been made out between them.

We are thus reminded of Dr. Flemming's description of his carboniferous or Devonian formation in the western end of the Salt Range of the Punjaub, which contained *Orthoceratites* and *Ammonites* together (apparently the same as those found by Dr. Cook), and where these strata were only separated from the ferruginous clay or lower member here of the nummulitic series, by a thin bed of crystalline grey limestone, containing a few *Encrinites* and *Terebratulæ;* while in the Kafir Kote Range, so far as Dr. Flemming had an opportunity of examining, these "Carboniferous" rocks are in immediate relation with the tertiary sandstones and clays, no nummulite limestone or oolitic rocks intervening.

Dr. Cook has not forwarded any specimens of *Producta* or *Terebratulæ*, but he is on the threshold, as all geologists will see, of a most interesting inquiry. Of the fossils from the Eocene formation, which he has sent down, two foraminifera, viz :—a *Nummulite* and an *Orbitolina* are new, but these, as well as a selection from his other fossils will, in accordance with his wish, be hereafter laid before the Geological Society of London for description and record.

There are many other interesting observations in Dr. Cook's valuable communication, which must be deferred for publication hereafter in the Society's "Transactions."

Dr. H. Vandyke Carter then read a paper entitled "A preliminary account of a disease of the foot, caused by the development of a vegetable fungus."

The affection of the foot described in this paper is one very common in several parts of this Presidency, as well as in certain localities of that of Madras. It was from an examination of two cases that lately were

admitted into the Jamsetjee Jejeebhoy Hospital, that Dr. H. Vandyke Carter was enabled to detect the true nature of the disease. It appears that a fungus-growth obtains an entrance into the tissues of the foot, and by gradual development and spreading comes to occupy a large part of the entire foot, producing a tumour or swelling which is characteristic in form and appearance, being marked by the presence of numerous tubercles which have sinuous openings connected with them. The mode in which the bones become affected was described as peculiar and characteristic. Specimens were shown, and drawings made by the author, to illustrate the description. Two or probably three varieties of the disease were indicated. Information concerning what may be called the Medical History of the disease had been obtained from two Medical Officers of the Madras Army, Drs. Day and Colebrooke, and also from two Graduates of the Grant Medical College, Messrs. Bazunjee Rustomjee and Sudasew Hemraz, to whom the author expressed himself more particularly indebted for copious written information and for specimens. The facts elicited from these sources fully bore out the opinion, that this disease is *sui generis*—it is endemic—has an almost invariable local manifestation in the foot—occurs commonest by far in men—attacks all ages, though generally about the middle periods of life—the patients are mostly agriculturists—the disease is of long duration—and amputation, though the only remedy, is yet a certain cure. It was yet doubtful as to the place of classification of this fungus growth. A memorandum by Mr. H. J. Carter, with which the author had been favored, clearly showed the affinities of this fungus to some of those already known as parasitic in their nature; but the genus and specific name have yet to be given. Taking it as a whole, this affection may well be compared to the guinea-worm disease, with which, in interest and importance, it, in the author's opinion, fully deserves to be classified. A few general remarks on vegetable fungi, with respect to their specific distinction, and the conditions of their appearance, closed the communication, which will probably be published '*in extenso*,' in the next volume of the "Transactions."*

Dr. Glasse then read an interesting case which had lately been under his care, illustrating reflex action in a remarkable degree.

About forty calculi, extracted by Dr. Stedman, Civil Surgeon, Hydrabad, Scinde, were laid on the table. This collection is a valuable acquisition to the history of calculous disease as occurring in India,

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* See page 104 *ante*.

and it appears to confirm the conclusions derived from analysis of the specimens in the Grant College Museum, namely, a paucity of uric acid and urate of ammonia species, and a large number of the oxalate of lime (combined with phosphate) variety. Many of the specimens are remarkable for their form and appearance, and one or two for their size--one in particular, where three very large calculi were found in the bladder. An analysis of these specimens, or of parts of them, would doubtless furnish many interesting facts. For their successful extraction, due credit should be given to Dr. Stedman, who, as an able and skilful lithotomist, operated, in 1859, on forty-four cases of stone (with only two deaths), particulars of which will be found at p. 264, Vol. V. of the Society's Transactions.

Specimens of arrow-root, indigenous and foreign, were exhibited from Rutnagherry, having been forwarded by Dr. DeCrespigny. Dr. Birdwood remarked that the indigenous variety called "*Kutchoora*" consists evidently of the rhizomes of a scitamineous plant, probably the *Curcuma caulina* of Graham's Catalogue of the Flora of Bombay, the *Curcuma montana* of Roxburgh's Flora Indica (plate 151). These rhizomes when crushed and washed yield an excellent farina. The foreign sample consisted of the tubers of the true arrow-root plant, the *Maranta arundinacea* of the West Indies. They were very fine and healthy, but not so large as those grown in the Horticultural Society's Gardens at Kirkee. As this species flourishes with the greatest productiveness in this country, as has been fully determined at Rutnagherry, Kirkee, Mahableshwar, and Kamptee, and as its farina is far superior to that of *Kutchoora*, its cultivation should be everwhere substituted for that of the latter, for notwithstanding the almost prohibitive price of imported West Indian arrow-root, it is always preferred when procurable to the indigenous or East Indian variety.

After the best thanks of the Society had been accorded to the contributors of papers, the President announced that the meeting was adjourned over the recess of three months, and that the next meeting would be held on the first Saturday in July 1860.

No. 3.

MONTHLY MEETING HELD 7TH JULY 1860.

Present :

J. Scott, Esq., Acting Principal Inspector General of the Medical Department, *one of the Patrons of the Society;* A. H. Leith, M.D., *President*, in the chair; H. J. Carter, Esq., F.R.S.; J. Peet, M.D., *Vice-Presidents.*

Members.—H. D. Glasse, Esq.; R. Haines, M.B.; G. C. M. Birdwood, M.D.; H. V. Carter, M.D.; and W. C. Coles, M.D., *Secretary.*

The proceedings of the last meeting were confirmed, after an abstract of them had been read.

The following new members were elected:—Assistant Surgeons F. T. Ffolliott, H. Taylor, and R. A. Alleyne, on admission to the Service, as members for two years under Regulation VII.; Assistant Surgeon W. J. Moore, M.D., Acting Civil Surgeon, Bhooj, as subscribing member under Regulation V.

Letters were read acknowledging the receipt of the last volume of the Society's Transactions from the Registrar of the Royal College of Physicians, London; from the Registrar of the King's and Queen's College of Physicians in Ireland; from the Secretary to the Council of the Epidemiological Society, London; from the Secretary to the Bombay Mechanics' Institution; and from Dr. Ewart, Kherwarra. Letters also were read from Assistant Surgeons Moore, Thorold, and Colston, on the business of the Society.

The presents and donations to the Library, since the last meeting, were as follows:—the fortnightly Numbers of *The Indian Lancet*, and the weekly ones of *The British Medical Journal*, forwarded regularly by the Editors, in exchange for the Society's Transactions. Presented by the authors:—"Vital Statistics of the Meywar Bheel Corps," by Joseph Ewart, Esq., M.D., Bengal Medical Service. "Observations on the Bed and Delta of the Nile," and "On the Source of the White Nile," by Dr. G. M. Birdwood, Bombay. From the Acting Principal Inspector General of the Medical Department, the "Administration Reports for the year 1858-59;" "Ewart's Vital Statistics of the Indian Army;" "The Indian Annals of Medical Science, vol. 12;" and the "Annual Report of the Madras Medical College for 1859."

The first paper submitted to the Meeting was the Annual Report of the Kelat Agency for the year 1859-60, by Dr. Cook, of which the following is a brief abstract.

The Kelat Mission was marching nearly the whole of the year. In April and in May it was in Kutchee; in June at Mutsong and Quetta; from July to November at Kelat; in November it proceeded to Khozdar, where it remained till March, when it reached Muskha in Mekran.

A sketch of the climate of each successive month, changing with the varying altitude above the sea, and its effects on the health of the detachment forming the escort is given, and particularly valuable data is thus furnished, in the event of any future Military occupation of the country, or for the purpose of establishing Sanitaria.

Besides attending to the medical wants of the Mission, Dr. Cook afforded medical aid to the natives of the countries through which they passed, and thus 728 patients were treated during the year, of which 400 were cured, 207 relieved, 99 not traced, 14 remained, and 3 died. Dr. Cook says, "The season for affording medical aid to the population of the table-land of Beloochistan is necessarily restricted in a great degree to the summer months, by the practice so general amongst the people of migrating on the commencement of the cold season to the plains. About the middle of September the attendance at hospital falls off, and one after another of the patients requests permission to return to their friends who are preparing for their journey into Kutchee. At the commencement of the month, the daily attendance averages 40·5; whilst at its close, only 8. There are several reasons why amongst the list of relieved so many names appear: *1st*. Many had to come from long distances, 70, 80, or 100 miles, and in one or two instances even from Khandahar, and on being relieved from present discomfort or pain, and feeling anxious to return to their families as soon as possible, had expressed themselves contented, and withdrawn. *2nd*. Others, little understanding the course of ordinary and rational treatment, but believing most devoutly in charms and supernatural means of cure, fancied they had but to *see* the Doctor to have immediate relief; and on finding that no such instantaneous cure could be effected, but that time was necessary ere the remedies could work their good effect, gave up further attendance and returned to their homes. *3rd*. A large number of the cases treated were chronic eye diseases, the restorative process difficult to set up and notoriously long in action, and lastly, from the fact of our having traversed so large a portion of the country, and of our stay at many places being limited to a few days, the good effected in chronic diseases was but partial."

Dr. Cook then enters into particulars with respect to some of the diseases observed; combats the opinion of Dr. Martin respecting malaria being arrested by mere elevation, and says "Kelat stands 7,000 feet above the sea, is the highest inhabited spot of the whole of the Beloochistan table-land, is well-drained, and not too thickly populated; its soil is light and dry, and there is no waste water in the valley, yet the malaria of intermittent fever is certainly not extinguished, and the causes which produce it are still operating." He agrees more with Dr. McClelland, in his Medical Topography of Bengal, recently published, that free drainage is the most direct means of counteracting the influence of malaria. He says (page 138) "Free drainage is the most direct means of counteracting the influence of malaria, and this is

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naturally attained more particularly on isolated mountain elevations; such situations are usually free from fevers, although these maladies are not uncommon in warm mountain valleys, thus proving that *it is only in proportion as mountains are better drained and ventilated than plains, that they are more free from fever.*" Dr. Cook adds "mere elevation above the sea, therefore, is not sufficient of itself to insure a freedom from intermittent fever; good drainage, free ventilation, and a moderate temperature, are essentials to be considered when fixing the position of sanitaria, and even these, in the case of Kelat, are not apparently absolutely effective in extinguishing malaria." After passing in review each class of disease met with, Dr. Cook concludes his interesting paper with a slight sketch of the medical treatment practised by the native huckeems. He says "the Brahmins themselves understand little or nothing of medicine, but in all diseases are in the habit of resorting to *Faqueers*, *Piers*, and men of holy reputation for charms, in which they devoutly believe. A few herbs, similar to those found in the bazars of Shikarpore, Kurrachee, &c. are also sold by the Bunias of Kelat, and amongst the hills are a few plants of fragrant odour which they make into an infusion and take as tonics. In the Murree hills also, and in the Bolan Pass, is found a plant bearing a yellow berry, exceedingly bitter in taste, called *Peepullee*, which they employ as a febrifuge, and probably with success. Counter-irritation is familiarly employed amongst them, and is extensively used in almost all diseases in the form of the actual cautery. They roll up a piece of cloth, set it on fire, and apply it to the skin until an *eschar* is formed. I rarely met with a chronic case of splenitis and hepatitis in which the surface of the abdomen was not studded with the sores formed by these eschars. In other diseases, also, in which there was no local and apparent disorder, they applied the cautery fantastically to various parts of the body, such as the bend of the elbow, the ankle, &c. They employ venesection in much the same empirical manner. A vein is opened in both arms simultaneously, and a few drops of blood only abstracted; when the wound is again closed. The use of leeches is understood, but they are very sparingly used, and, from their high price, are placed beyond the reach of the common people. This is the extent of their rational (?) treatment, for the rest, they trust, as before stated, to supernatural means of cure, to which at all times they give the preference."

Dr. H. Vandyke Carter then read a case of hemiplegia, and hemianasthesia, which in a marked degree illustrated Dr. Brown-Sequard's views as to the decussation of the sensory filaments in the spinal cord.

The patient had received an injury in the upper part of the spinal column. He became hemiplegic on the right side, sensation being unimpaired. Upon the opposite there was anasthesia of the upper and lower extremities, motion being unimpaired. Dr. Carter pointed out that this case could not be explained in any other way than by the admission of the crossing of the sensory filaments in the way stated by Brown-Sequard. His idea is, that probably blood had been effused into the right half of the spinal cord destroying the conducting motor filaments on that side, and the *sensory* filaments which pass to the opposite side.

Dr. Carter gave a summary of Dr. Brown-Sequard's discoveries in connection with the nervous system, and expressed his belief that the most important discovery—the decussation of the sensory filaments—might be considered as fully established.

After the best thanks of the meeting had been accorded to the contributors, it was adjourned to Saturday the 4th August.

No. 4.

MONTHLY MEETING HELD 4TH AUGUST 1860.

Present :

A. H. Leith, M.D., *President*, in the Chair ; H. J. Carter, Esq., F.R.S., *Vice-President.*

Members.—J. Scott, Esq. ; W. Arbuckle, M.D. ; H. D. Glasse, Esq. ; W. Campbell, M.D. ; R. Haines, M.B. ; G. R. Ballingall, M.D. ; W. G. Hunter, Esq. ; J. Welsh, Esq. ; G. C. M. Birdwood, M.D. ; G. C. Bell, M.D. ; H. V. Carter, M.D. ; and W. C. Coles, M.D., *Secretary.*

The proceedings of the last Meeting, held on the 7th July, were read and confirmed.

Dr. Diver, of Bombay, was proposed by Dr. Ballingall and seconded by Dr. Campbell as a member of the Society under Regulation No. VI., to be ballotted for at the next meeting.

Letters were read from the Acting Principal of the Grant Medical College, forwarding the College Report of 1859-60 ; from the Secretary of the Royal Institution, Great Britain, acknowledging the receipt of Volume IV., of the Society's Transactions ; from Assistant-Sur-

geon Atkins, relative to the last volume of the Transactions, which through inadvertence, had not been sent him, but which has since been forwarded.

The presents to the Society's Library were as follows :—From the Acting Principal Inspector General Medical Department, Selections from the Public Correspondence of the Punjaub Government, volume 4 ; Annual Report of Vaccination, 1859, Madras. From the Editors of the Madras *Quarterly Journal*, the 1st number of the Journal. Two numbers of the *British Medical Journal*, and one of the *Indian Lancet*, received since the last meeting, were laid upon the table.

A tray containing 18 calculi, extracted by Dr. Stedman of Hydrabad, since January 1860, for presentation to the Museum of the Grant Medical College, was placed on the table.

A Report on the Sanitarium of Poorundhur, for transmission to the Army Medical Department in England, by Assistant Surgeon Plumptre, drawn up at the request of the Deputy Inspector General of Home Troops, was read. The Report embraces,—1. A description of the Geographical position of Poorundhur. 2. An account of the Sanitarium buildings. 3. The climate and general Meteorology of Poorundhur ; and, 4. The effect upon the European constitution and the class of diseases for which residence at the Sanitarium is best adapted, and for which marked benefit may be expected. Dr. Plumptre quotes Dr. Morehead's general description of the Hill of Poorundhur as follows : —"The Hill on which the Fort of Poorundhur is placed is an off-shoot from the easterly side of the Western Ghaut range. It is situated in 18° 22′ N. Latitude, and 73° 54′ E. Longitude, and is distant nineteen miles from Poona. It is a saddle-backed mountain. The altitude of the highest part of the ridge is 4,570 feet ; but that of the lower Fort, in which the Sanitarium is located, is 4,200 feet. The lower Fort occupies a narrow table, about a mile in length, projecting from the northern slope of the mountain. A good foot-road has been carried round the hill on the level of the Sanitarium, as well as round Wuzeerghur, an adjoining hill, connected at the same level by a narrow ridge to Poorundhur. This foot-road is about seven miles in extent ; and, in consequence of its circular character, its position 230 feet below the highest ridge, and the general form and direction of the mountain, there is space for exercise shaded from the sun until 9 or 10 in the morning." The strictly speaking meteorological report having already appeared in the Transactions of the Society is omitted ; but with regard to the climate and general meteorology Dr. Plumptre observes as follows ;—

"The year at Poorundhur is divided into three seasons:—*the hot, rainy* or *monsoon*, and *the cold. The hot season* is the one most suitable to develope the benefits likely to arise from change to a hill climate, and by avoiding the heat of the plains. This season may be considered as beginning about the first week in March, and terminating in the middle of June. The great distinctive feature which marks the difference of the climate from the plains at this season, is the general absence of hot winds, and the almost total exemption this place enjoys of anything like hot nights. A cool fresh breeze from the N.W. sets in nearly every evening a little before sunset, and continues thoughout the night. About the middle of April the thunder showers begin generally from the N. and N.E., and these occur at frequent intervals, increasing in violence until about the middle of June, when the rainy season sets in. About the middle of May, indications of the approaching monsoon are manifested by large masses of clouds being seen on the surrounding hills, towards the S. W., which sometimes extend to this, occurring most frequently in the morning, but sometimes in the evening also. The weather at this season is particularly pleasant, the mornings cool and bracing, and, combined with the increasing beauty of the scenery around, and the vivid verdure of the country, has a very exhilirating effect. I have, however, observed that at this season some of the convalescents who have suffered much from intermittent fever, are prone to recurrences of these attacks.

The *rainy season* extends from the middle of June to the end of September. The general character of the weather is gloomy in the extreme, for days and weeks together the hill is enveloped in mist, accompanied by constant drizzling rain; evaporation is entirely suspended. The Sanitarium is open at this period, although the number of men is very much reduced, and the cases are carefully selected. The men remaining at this time, are generally those who have been resident for some months, whose Regiments are located at a distance (the season preventing their rejoining), and cases which are to appear before the Invaliding Board. The effect of the climate of this season upon the majority of the men is unfavorable, not that it increases their ailments, a few cases excepted, but that it retards the progress of their recovery. The gloomy state of the weather, the absence of all sunshine for weeks together, combined with the impossibility of the men taking exercise without getting wet through, tend to produce an injurious influence, and great depression of spirits. It is, therefore, unadvisable to send men to the Sanitarium at this season,

more especially if they are Hospital cases, the dark state of the wards being an additional objection. During this season, one or two breaks generally occur in the weather, and continue for a week or ten days, and then it is difficult to imagine a more delicious climate.

October and November must be considered separately, or as partaking somewhat of the character both of the hot and cold seasons. The weather during the day is moderately warm, and during the evenings and mornings, cool. Frequent showers occur in October. This month is generally considered unhealthy in the Dekkan : many weakly men are therefore annually sent here at this season to avoid the climate below ; and they derive much benefit therefrom.

The *cold season* extends from about the 10th of November to the beginning of March, and is not considered a favorable season for the majority of invalids. The strong dry cold winds which then prevail produces rapid evaporation from the surface of the body, with a disposition to internal visceral congestion, and is, therefore, decidedly unsuited to delicate men, especially those who have suffered from hepatitis, spleen diseases, dysentery, or rheumatism."

The paper concludes with an enumeration of the diseases for which Poorundhur is best adapted.

An interesting account of the hot springs at *Oonaye*, near Surat, by Surgeon Pelly, was then read. A diagram of the tanks fed by the springs, and tables of the range of the thermometer for the 4th, 5th, 6th, and 7th days of April and May last, are given, being the periods under observation, to determine whether, as popularly alleged, the water in the tanks is hotter at the full moon in April each year, when a larger number of devotees attend than at any other period.

In the four days in April, whilst the temperature of the air at noon ranged from 90° to 96°, that of the water in the tanks varied from 112° to 116°.

In May, the atmospheric temperature had considerably risen; and the thermometer daily, at 3 P. M., stood above 100°; at the same time there was a marked increase in the temperature of the water in the springs, the thermometer indicating 143°, thereby disproving the popular belief of the effect of the *April Full Moon* on the temperature of the water."

A short communication was made by Dr. Glasse, in which, reasoning by analogy of an accidentally formed syphon which he described, he thought that by it the cause of intermitting springs, such as that of the "Pool of Siloam," and the "Rajpoor Springs" in the Concan, might probably be explained.

Mr. Carter drew the attention of the Meeting to a microscopic Nematoid worm which infested the common house-fly (*Musca Domestica*). He stated that he had been induced to direct his attention to it, in the hope that it would throw some light on the origin of the guinea-worm in the human subject. While doing this, he had found that the ova of the worm also existed in many parts of the body of the fly, especially in the tissues of the head; and they were in all stages of developement from their first appearance in a tubular net-work, up to their isolated state just previous to impregnation or the disappearance of the germinal vesicle; but beyond this he had not met with even a single instance. Almost every fly contained masses of these ova; and almost every third fly a number of full-grown worms, which were chiefly congregated in the proboscis. The ova were supplied with trachæa, showing that they were nourished by the fly, whatever might have been the form of the parent which deposited them, no traces of which, with the ova, even at the earliest stage that they had been seen, had been observed. On the other hand, the full grown worms were all males, and bore evident signs from their maturity that they were on their way to impregnate the ova, as the latter became prepared for this among the soft tissues of the fly's body. What became of the eggs afterwards, Mr. Carter had not been able to discover, but, knowing that several of the entozoa were hatched in one animal, and laid their eggs in another, he thought that the former might be found to take place in the alimentary canal of the white crane or paddy bird (*Ardea Modesta ?*), which lives greatly upon the common house-fly; or, they might fall from the fly on the food of some other animal, and thus get into the body of their second host. All he had yet been able to determine on the subject, was that the eggs were deposited in the fly; that they subsequently became nourished and brought into a state ready for impregnation by the fly; that the presence of nothing else but males, particularly congregated in the probocis, indicated that they were thus, on their way for this purpose; and that the probability was that the eggs were afterwards transferred to the body of some other animal for hatching.

Mr. Carter observed that as yet he had not discovered the female; and that although, so far, his investigations had thrown no light on the origin of the guinea-worm, they had at least enabled him to determine what was satisfactory to know, that the species was so different from the guinea-worm that the latter could in no way be derived from it. The form of the male led him to consider this parasite of the fly nearest of all allied to the *ascarides*.

Dr. Ballingall then read an interesting case of reducible hernia cured by pressure; and exhibited the instruments employed, and the patient operated upon.

After the best thanks of the Meeting had been accorded to contributors, it was adjourned to Saturday the 1st September next.

No. 5.

MONTHLY MEETING HELD 1st SEPTEMBER 1860.

Present:

A. H. Leith, M.D., *President,* in the Chair; H. J. Carter, F.R.S., and J. Peet, M.D., F.R.C.P., *Vice-Presidents.*

Members.—H. D. Glasse, Esq.; W. Campbell, M.D.; T. B. Johnstone, M.D.; C. C. Mead, Esq.; R. Haines, M.B.; W. G. Hunter, Esq., and W. C. Coles, M.D., *Secretary.*

The proceedings of the last meeting, held on the 7th August, were read and confirmed. Agreeably to the 6th Regulation of the Society, Dr. T. Diver, of Bombay, having been at the last meeting duly proposed and seconded, was now elected by ballot an ordinary member of the Society. Under Regulation V., J. Ogilvy, M.D., Assistant Surgeon H. M.'s 33rd Regiment, in Medical charge of Aboo Sanitarium, was elected an ordinary member of the Society. Dr. Ogilvy's letter of application, dated 22nd August, intimating also the transmission of his fees and subscription, was read. A letter was read from E. Waring, M.D., Physician to His Highness the Rajah of Travancore, dated Trevandrum, 7th August 1860, forwarding, for the acceptance of the Society, two pamphlets (Reprints) on some of the medicinal plants of India.

Two numbers of the *British Medical Journal,* and two numbers of the *Indian Lancet,* received during the month, were laid upon the table. The first paper presented and read to the meeting was an elaborate and valuable monograph, by Dr. W. J. Moore, M.D., Acting Civil Surgeon, Bhooj, entitled "Notes on the Physiology of the Pancreas." In this paper, the author reviews nearly all that has been written on the subject of the anatomy and physiology of the pancreas, and the uses of the pancreatic fluid, both in the English and foreign languages; and after stating the more modern views on the subject, details his own interesting experiments, and summarises the conclusions to which he has been led. The author promises a further contribution regarding

the diseases of the pancreas, which will, with the present paper, probably appear in the forthcoming volume of the Society's Transactions. *

An account of the natural and physical features of Upper Sind, by Assistant Surgeon J. Lalor, 2nd Regiment Sind Horse, forming a portion of his Annual Medical Report, was read. The writer does not enter particularly upon the Topography of Jacobabad, as it has often been before described, but gives an account of the climate of Upper Sind; notices the winds, rains, dust-storms, mirage, electrical phenomena, atmospheric disturbances, &c.; and says, with respect to the climate of the frontier districts of Upper Sind that "if it is not considered the worst, it certainly is the most trying to the constitution of any in the world. The average mean temperature during the hot months may be fairly stated at 93° day and night, with all doors and windows shut, but the opening of a door will sometimes make a difference of five or six degrees.

Dr. Lalor then enters upon the subject of agriculture in Upper Sind; and in anticipation of a more detailed account of the botany of Upper Sind, which is promised, refers to the more common vegetable products arranged according to their natural families. †

Mr. Carter then stated to the Society, with reference to the nematoid worm which infests the common housefly mentioned at last meeting, that he had since discovered that this worm was bisexual, and that further observation had led him to class it with the *Filaridæ* rather than with the *Ascarides*; it was, with the exception of one discovered by M. A. Schneider, in snails, the first of the kind that had been noticed, while that of M. Schneider differed in not having separate organs for the production of the sperm-cells and germ-cells, but a simple cylindrical tube in which both elements were produced, and thus a new generation brought forth,—a state of organology which might furnish an excellent explanation for the manner in which the guinea-worm, in its isolated condition in the human subject, occurs filled with young ones. The one which Mr. Carter thought he had discovered in different parts of the fly, he now finds to be nucleated cells, which are in direct continuation with the vascular tissue of the tracheæ, and on which ultimate branches of the latter terminate; structures which seem as yet to have been almost overlooked, so little notice has been taken of them. A group of these cell appendages, differing somewhat from those in the head, exists in each lobe of the extremity of the proboscis of the fly, but they cannot be seen well under a power of 350 diameters.

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* See page 143 *ante*.

† See page 315 *ante*.

After the best thanks of the meeting had been accorded to the contributors of papers, it was adjourned to Saturday, the 6th October 1860.

No. 6.

MONTHLY MEETING HELD 6TH OCTOBER 1860.

Present :

A. H. Leith, M.D., *President*, in the Chair; H. J. Carter, Esq., F.R.S., and J. Peet, M.D., F.R.C.P., *Vice-Presidents.*

Members.—H. D. Glasse, Esq.; W. Campbell, M.D.; C. C. Mead, Esq.; R. Haines, M.B.; G. C. M. Birdwood, M.D.; J. Mennie, Esq.; and W. C. Coles, M.D., *Secretary.*

The proceedings of the last meeting, held on the 1st September, were read and confirmed.

One number of *The Dublin Quarterly Review*, two numbers of *The British Medical Journal*, and two numbers of *The Indian Lancet*, received since last meeting, were laid upon the table.

A Topographical and Medical account of Mount Aboo, by Assistant Surgeon John Ogilvy, M.D., H. M.'s 33rd Regiment, in medical charge, presented by the Acting Principal Inspector General of the Medical Department, was read. This is an elaborate and carefully prepared document; and, although there have been several descriptions of Mount Aboo brought before the Society, and some of them published in its Transactions, yet it was considered that there is room for Dr. Ogilvy's clearly-expressed, concise, yet complete, paper on the subject.* The heads under which the author divides the subject are geographical and historical, including the discovery and first ascent of Mount Aboo, and when its capabilities as a Sanitarium were first tested. Then follows a descriptive account of Mount Aboo, its landscapes, ghats, the Aboo lake, roads, route, &c.; the geological features, villages, aborigines, population, irrigation, crops, vegetables, fruits, &c.; the soil, seasons, temperature, the monsoon, drying-up period, and cold season; remarks on the selection of sites, the roads, the station, and its buildings, objects of interest, schools, &c.; general remarks on hill stations, with reference to their capabilities for acclimatizing Europeans, rearing of children, &c., specially applied to Mount Aboo, the Lawrence School, &c.; cases of invalids that are and that are not benefited by the Aboo climate; suggestions regarding sites for barracks, hospitals, &c. &c.

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* See page 192 *ante*.

The next paper read to the meeting was on the diseases of the pancreas, by Dr. Moore, Civil Surgeon, Bhooj. This was in continuation of the author's former paper on the anatomy and physiology of the pancreas, and will be published with it in the Transactions. * The subject of diseases of the pancreas and their treatment is a very intricate one, and has engaged the attention of many British and Continental writers; their views and opinions are set forth and analysed in the present paper, and Dr. Moore has added his own opinions, based upon an unusually large experience, of this rather uncommon affection. The monograph was considered by the meeting to be an interesting and valuable contribution to medical literature.

In the unavoidable absence of Dr. Vandyke Carter, a preparation and drawing of the *pacinian* bodies in leprosy were exhibited, and the description which accompanied them read. As this paper is only the first of a series of Pathological Notes to be presented to the Society, it will be more fully noticed hereafter. Two highly interesting cases of hepatic abscess,†—one occurring in a child 17 months old, and the other in which life was prolonged for many days, after extensive peritonitis had been set up, by the bursting of an hepatic abscess,—kindly forwarded by Assistant Surgeon Chapple, Royal Artillery, Poona, were read; and afterwards a somewhat remarkable instance of speedy death, due, it was supposed, to a caterpillar having been accidentally swallowed, narrated by Dr. M. Mackenzie, Civil Surgeon, Sattara.

After the best thanks of the meeting had been accorded to the contributors of papers, it was adjourned to Saturday, 3rd November 1860.

No. 7.

MONTHLY MEETING HELD 3RD NOVEMBER 1860.

Present:

A. H. Leith, M.D., *President*, in the Chair; H. J. Carter, Esq., F.R.S., and J. Peet, M.D., F.R.C.P., *Vice-Presidents.*

Members.—W. Arbuckle, M.D.; R. Haines, M.B.; W. G. Hunter, Esq.; G. C. Birdwood, M.D.; G. C. Bell, M.D.; T. Diver, M.D.; and W. C. Coles, M.D., *Secretary*.

The proceedings of the Committee Meeting held on the 6th ultimo, and of the last Ordinary Meeting, were read and confirmed.

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* See page 143 *ante*.

† See page 47, 48, Appendix.

Letters were read from the Secretary of the Geographical Society, forwarding the 15th Volume of the Geographical Society's Transactions; from Major Merewether, Political Superintendent Sind Frontier, forwarding a manuscript paper by Assistant Surgeon H. Cook.

The presents since the last Meeting, laid upon the Table, were two Numbers of the *British Medical Journal*, one Number of the *Indian Lancet*, the Transactions of the Geographical Society, the 2nd Number of the *Madras Quarterly Journal*, and the Mortuary Report, or Deaths in Bombay, for 1859.

The first paper brought before the Meeting was a "Topographical and Geological Report on a portion of Jhalawan, and the Eastern Division of Mekran," by Dr. H. Cook. The account is drawn up in the form of a diary, as Dr. Cook states "That the minutiæ (usually characteristic of this form of writing) might prove useful, if not interesting, from the fact of a great portion of the tract traversed having been before unknown and unvisited by Europeans." In Dr. Cook's former communication, he gave an account of the valleys in the province of Sarawan, from Quetta to Kelat. In the present, he describes parts of the country between Kelat and Khozdar. He states that, leaving Kelat, the party proceeded eastward to Penderan, and then southwest until they struck into the great southern route leading to Beyla, somewhere above Bagwana, from whence they followed this route on to Khozdar, where they staid some time to afford an opportunity of making excursions into the neighbourhood. Then stretching away to the westward, they came to Nál, where their march southward ended, and wheeling round towards the north, they returned to Kelat by Sohrab and the Taigab river, having followed the latter for 100 miles up to its source, about six miles from Kelat. The time occupied on the journey was from November 1859 to April 1860 (inclusive). Throughout this period Dr. Cook made copious notes of what presented itself to him, and what he personally examined, especially in relation to the geography, geology, ethnology, agriculture, botany, natural products, and antiquities of the country through which he passed. He gives a fac-simile of an inscription found on a rock, which appears to be in the "*cave character*," mentions the several Geological sections he came across, and the lead-mines near Khozdar which he describes, as well as other objects and incidents of interest, all of which must be deferred for the publication of his paper in the forthcoming number of the Society's Transactions. *

* See page 45 *ante*.

The Annual Report of the European General Hospital, ending 31st March 1860, was then read, from which it appears that, partly owing to the want of sufficient accommodation in the Hospital, and partly to other causes, only 1,596 patients were treated in the wards of the Hospital during the year, of which number 139 died, in the proportion of 8·7 per cent., and 122 remained on the 1st April 1860. The mortality was due to dysentery and other diseases of the stomach and bowels in 41 instances, in 29 to cholera, in 19 to diseases of the lungs, in 13 to those of the brain, in 12 to those of the liver, in 7 to remittent fever, and in the remaining 18 cases, to various other causes. Respecting each form of disease—its symptoms, treatment, and *post-mortem* appearance, very valuable information is afforded as the result of long-continued and accurate observations, and of minute and painstaking investigations. The Report will be published as usual in the next number of the Transactions.*

Notes of three cases of cholera by Dr. Lownds were then read, which referred chiefly to the mode of treatment adopted in the stage of collapse.

Mr. Carter mentioned a remarkable case of Guinea-worm, in which 43 of these *Entozoa* had been extracted from the feet of one individual, viz. 27 from the right, and 16 from the left foot. They had all been taken out by a "Syed," a native doctor, and chiefly with a cupping vessel. Mr. Carter thought it worth while to bring the case before the Society, because it had come under his own notice, and the facts were correct as to the number of worms extracted, whilst it gave him an opportunity of describing the mode of treatment adopted, which he considered the most successful he had seen. Mr. Carter observed with reference to the course by which the parasite was introduced into the body, that all the worms were confined to the feet, and that the balance of evidence was in favor of the external origin of the Guinea-worm.

After the best thanks of the meeting was accorded to the contributors of papers, it was adjourned to Saturday, the 1st December next.

No. 8.

MONTHLY MEETING HELD 1st DECEMBER 1860.

Present :

A. H. Leith, M.D., *President*, in the Chair; H. J. Carter, Esq., F.R.S., and J. Peet, M.D., F.R.C.P., *Vice-Presidents*.

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* See page 217 *ante*.

Members.—W. Campbell, M.D.; H. Giraud, M.D.; R. Haines, M.B.; J. Welsh, Esq.; W. G. Hunter, Esq.; G. C. M. Birdwood, M.D.; H. V. Carter, M.D.; T. Diver, M.D.; and W. C. Coles, M.D., *Secretary*.

Letters were read from Assistant Surgeons Riddell and Hopkins, expressing their wish not to become subscribing members; from J. T. Mackenzie, M.B., R. Bowstead, Esq., and G. Asher, Esq., requesting that they might continue ordinary members of the Society; from the Agent to the *Madras Quarterly Medical Journal*, stating that the numbers of that periodical were sent in exchange for the Society's Transactions. Two numbers of the *British Medical Journal* and two numbers of the *Indian Lancet*, received since the last meeting, were laid upon the table.

The first paper read was on the Density, Reaction, &c., of Urine of persons in health, as observed in Bombay, by Dr. Peet, which will be hereafter published in the Society's Transactions. * Dr. H. V. Carter then exhibited some pathological preparations illustrative of the peculiar disease of the foot, lately described by him, and read a series of remarkably interesting medical cases, which will also be published in the Society's Transactions.

The other papers brought before the meeting were the Medical Topography of Aden, by Sub-Assistant Surgeon Ruttonjee Hormusjee; the Medical Topography of Bhooj, and an account of the prevalent diseases as they occurred in the Kutch Levy Hospital, by Assistant Surgeon Moore, M.D.; a description of the Dumma Towers on the Halla range of Hills in Sind, by Assistant Surgeon Lalor, Sind Horse; a contribution to the Sanitation of Barracks, by T. Lownds, M.D.; the Annual Report of the 10th Regt. N.I., by Assistant Surgeon Murray; and several annual, civil, and other reports from the office of the Principal Inspector General.

After the best thanks of the Meeting were accorded to the contributors, it was adjourned to the first Saturday in February 1861, as the Annual Meeting will be held on the 5th January next.

No. 9.

ANNUAL MEETING HELD 5TH JANUARY 1861.

Present.

A. H. Leith, M.D.; W. Arbuckle, M.D.; H. J. Carter, Esq., F.R.S.; W. Campbell, M.D.; J. Peet, M.D., F.R.C.P.; T. B.

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* See page 363 *ante*.

Johnstone, M.D.; W. C. Coles, M.D.; C. C. Mead, Esq.; R. Haines, M.B.; G. C. Birdwood, M.D.; and H. V. Carter, M.D.

The Secretary read the following Report:—

Annual Report.

During the year 1860, eight ordinary Monthly Meetings of the Society have been held, and the attendance of Members has averaged eleven upon each occasion. Only three Assistant Surgeons have been admitted into the Service during the past year, and consequently only that number have become Members of the Society under the rules of free admission. Four subscribing Members have, however, joined during the year, and the total number of paying members continues much as heretofore.

2. There have been about 12 volumes presented to the Library, besides the numbers of the "*Dublin Quarterly Review*," the "*British Medical Journal*," and the "*Indian Lancet*," which have been regularly received.

3. There has been no want of original contributions during the past year by non-resident Members, and the different subjects brought before the Meeting at the instance of Dr. Cook, Dr. Moore, and Dr. Lownds, need scarcely require to be mentioned, whilst the papers read by Members residing in Bombay must be fresh in the recollection of all; amongst the chief contributors, of which have been Dr. H. Vandyke Carter, and the Vice-Presidents.

4. The practice of forwarding communications from the office of the Principal Inspector-General of the Medical Department, has not been neglected during the past year, and several of considerable interest have been furnished.

5. The fifth number of the New Series of the Transactions was published about March last, and distributed as usual. It was anticipated that the volume for 1860 would also have been ready before the Annual Meeting, but delays have occurred with respect to printing the volume, which could not have been foreseen. It is hoped, however, that, before the recess, the sixth number of the Transactions will be ready for delivery, as considerable progress has lately been made towards passing it through the Press.

6. The accounts now laid upon the table will show that the finances of the Society are in a flourishing condition.

Annual Statement *of* Receipts *and* Disbursements *of the* Medical and Physical Society, *from* 1st *January to* 31st *December* 1860.

Receipts.	Rs.	a.	p.	Disbursements.	Rs.	a.	p.
By Balance of last account, closed on the 31st December 1859	1,655	7	11	By Amount paid for printing Circulars, &c.	56	0	0
By Subscriptions received from 1st January to 31st December 1860	769	0	0	By Office Establishment and Petty Charges, &c.	239	2	6
By Amount received from Government, being the value of 100 copies, No. 5 of the New Series of the Society's Transactions ..	500	0	0	By Amount paid for printing charges, No. 5 of the New Series of the Transactions..................	939	0	0
				By Balance in the Bombay Bank	1,690	5	5
Total..Rs.	2,924	7	11	Total..Rs.	2,924	7	11

The election of the Committee of Management for the year 1861, by the votes of all Members of the Society (who had recorded their votes) was declared. The following gentlemen were found to be elected :—A. H. Leith, M.D. ; W. Arbuckle, M.D. ; H. J. Carter, Esq., F.R.S. ; J. Peet, M.D., F.R.C.P. ; H. Giraud, M.D. ; W. C. Coles, M.D. ; R. Haines, M.B. ; and G. R. Ballingall, M.D.

The election of Office-bearers then took place, when Dr. Leith was elected President, and Mr. Carter and Dr. Peet, Vice-Presidents.

Upon a proposed addition to Regulation 20, which was submitted for vote, it was found that there were 37 votes in favor, and 2 votes against the proposition, consequently the following has become a portion of the Rule, *viz* :—" Should it be represented to the Committee that the conduct of a Member of the Society, is disgraceful, in a professional or social capacity, the Committee may, if they deem it necessary, bring the question of his expulsion before a Special Meeting of the Society, at which the votes of three-fourths of the Members present are necessary to decide it affirmatively."

REGULATIONS

OF THE

MEDICAL AND PHYSICAL SOCIETY OF BOMBAY.

ESTABLISHED 1835.

Objects.

I. The encouragement of the cultivation of Medical Science and its collateral branches, by discussion at periodical meetings, and by the publication of original communications.

Constitution.

II. The Society is composed of Ordinary, Corresponding, and Honorary Members.

Ordinary Members.

III. Under the head of Ordinary Members are to be classed all who contribute to the funds of the Society, and all who are admitted in accordance with Regulation VII.

IV. All Medical men residing in India, who can produce certificates of a regular medical education, are eligible as Ordinary Members.

V. Medical Officers of Her Majesty's Indian or British Services are elected Ordinary Members of the Society, on application by letter addressed to the Secretary.

VI. Qualified Medical Practitioners, not belonging to Her Majesty's Indian or British Services, are elected by ballot at the ordinary meetings of the Society, and a majority of three-fourths of the Members present is necessary to secure the election.

VII. Assistant Surgeons, on first entering the Bombay Medical Service, are considered Ordinary Members of the Society, free of the payment of admission fee and annual subscription, and continue so for a period of two years, after which, should they not intimate their wish to be considered Ordinary Members by payment of the regulated admission fee and annual subscription, they are considered to have withdrawn from the Society.

Payments.

VIII. Ordinary Members pay an admission fee of Rs. 5, and annual subscription of Rs. 12, payable in advance in the month of January of each year.

IX. Ordinary Members, absent from India, are not chargeable with subscriptions for the period of their absence.

X. Ordinary Members, neglecting to pay their annual subscription for two successive years, are considered to have withdrawn from the Society, and are liable to have their names erased from the list of Members, under a resolution passed to that effect at an ordinary meeting of the Society.

Corresponding Members.

XI. Ordinary Members, on retiring from service in India, on being proposed and seconded at an ordinary meeting of the Society, are eligible, by ballot, as Corresponding Members. A majority of four-fifths of the Members present is necessary to secure their election.

Honorary Members.

XII. Medical men of celebrity, not residing in India, are eligible as Honorary Members. On being proposed and seconded at an ordinary meeting of the Society, they may be elected at the next meeting by the unanimous consent of the Members present.

Election of Office-bearers.

XIII. The Committee of Management of the Society consists of eight Members, elected annually from among the Ordinary Members resident in Bombay, by the general vote of the Ordinary Members residing under the Government of Bombay.

XIV. The Voting Lists are circulated in the first week of November of each year, and the result of the election is declared at the annual meeting of the Society.

XV. In the event of vacancies occurring in the Committee between the periods of election, such vacancies to be filled up in rotation by the individuals who commanded the number of votes next to those of the Members returned at the last election.

XVI. A President and two Vice-Presidents of the Society are elected annually from among the Members of the Committee of Management by the Members of the Society present at the meeting at which the annual election of the Committee is declared.

XVII. The Secretary of the Society is elected biennially from among the Ordinary Members resident in Bombay at the annual meeting held in the month of January of alternate years, or, on the occurrence of a vacancy, at any other ordinary meeting of the Society.

Committee of Management.

XVIII. The Committee of Management have the general direction of the affairs of the Society, and decide on what communications are to be published in the Transactions of the Society. They keep minutes of all their proceedings,

which are entered into the Minute-book of the Society, and read at the following ordinary meeting.

XIX. When questions of importance to the stability and interests of the Society arise, they shall be submitted by the Committee for decision to the Ordinary Members residing *under the Government of Bombay*. The majority of votes necessary to decide any question, to be determined according to its importance, and fixed at the time by the Committee.

XX. It shall form part of the duty of the Committee to give due consideration to all suggestions offered by Members of the Society. Should it be represented to the Committee that the conduct of a Member of the Society is disgraceful, in a professional or social capacity, the Committee may, if they deem it necessary, bring the question of his expulsion before a Special Meeting of the Society, at which the votes of three-fourths of the Members present are necessary to decide it affirmatively.

President and Vice-Presidents.

XXI. The President shall take the Chair and conduct the business at all meetings of the Society.

XXII. In the absence of the President, one of the Vice-Presidents shall take the Chair, and conduct the business of the meeting; and in case neither be present, the senior Member at the meeting shall preside.

Secretary.

XXIII. The Secretary is a Member of the Committee of Management *ex officio*.

XXIV. It shall be his duty to enter into the Minute-book of the Society minutes of the proceedings of all meetings and transactions of the Society, and, in communication with the Committee of Management, to conduct the details of business, and carry on the correspondence of the Society.

XXV. The Secretary shall prepare an annual statement of the receipts and disbursements of the Society, to be laid before the annual meeting in the month of January of each year.

XXVI. To enable the Secretary to perform these duties, a suitable establishment is entertained, under the sanction of the Committee of Management, confirmed at an ordinary meeting of the Society.

Meetings.

XXVII. Ordinary meetings of the Society are held in Bombay on the first Saturday of every month, except in April, May, and June.

XXVIII. The chair being taken, the order of business shall be as follows:—

1. The minutes of the last meeting, and those of subsequent Committee meetings, to be read and confirmed.
2. The announcement and election of new Members, in accordance with Regulations V., VI., and VII.
3. The election of Corresponding and Honorary Members.
4. The reading of letters, and the discussion of any ordinary business of the Society which may be before the meeting.
5. The announcement of presents and donations.
6. That of papers and dissertations received since the last meeting.

XXIX. After the announcement of the papers and dissertations, the President shall call upon the Secretary to read one or more of them, and shall subsequently

invite the Members to discuss any particular part of them which they may consider deserving of remark.

XXX. No new business shall be introduced until that which is before the meeting has been concluded.

Papers and Dissertations.

XXXI. All papers and dissertations presented to the Society to be considered the property of the Society.

XXXII. The Transactions of the Society are published by the Secretary, in communication with the Committee, as often as circumstances will admit.

XXXIII. A copy of each publication is presented to the Honorary and Corresponding Members of the Society, and to every Ordinary Member who, at the time of publication, is a contributor to the funds of the Society.

N. B.—All communications addressed to the Secretary or Treasurers must be prepaid.

Members are requested to pay the amount of their subscriptions to the Bank of Bombay, Treasurers to the Society.

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